EXAMINING THE SUCCESS OF STUDENTS IN DEVELOPMENTAL MATHEMATIC COURSES IN A MOSTLY HISPANIC BORDER TOWN COMMUNITY COLLEGE

A Dissertation

by

ANTONIO GUADALUPE CARRANZA III

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Chair of Committee,	Mary Margaret Capraro,
Co-Chair of Committee,	Robert M. Capraro
Committee Members,	Gerald Kulm
	Graham Allen
Head of Department,	Yeping Li

May 2015

Major Subject: Curriculum and Instruction

ABSTRACT

A random sample of 200 Hispanic/Latino students from a predominately Hispanic/Latino South Texas community college was used to determine if the implementation of *MyMathLab* had a positive effect on students' academic grade performance. The purpose of this study was to explore whether a web-based technology, *MyMathLab*, made a difference in student success in both a developmental mathematics course and a subsequent College Algebra course. Additionally, this study examined whether the effect differs by instructors' characteristics contributing to successes or failures of students in developmental mathematics courses. Student success in developmental mathematics courses was measured by pre and post *MyMathLab* tests in addition to grade distributions from 2001 and 2005 (before *MyMathLab*) across the two developmental courses and a college algebra course and the implementation of *MyMathLab* between 2008-2012 to determine if using *MyMathLab* had an impact on student success in two developmental courses and an early algebra course. Also, the instructors completed two surveys. *The Mathematics Teaching Efficacy Belief Instrument* (MTEBI) and *Instructors Educational Philosophies* (IEP). The survey questions were compared to the results to determine if the instructors' characteristics had an impact on student's achievement in developmental courses enhanced by *MyMathLab*. The overall findings of the study suggests that with the implementation of *MyMathLab* taken on average the typical student was able to increase their academic performance in the developmental mathematic courses (Math0375, Math0376) and college algebra course (Math1314). The *PTE* overall findings suggest that mathematic instructors were

uncertain if they had the ability to teach effectively in the classroom. The *TOE* represented mathematics instructors were uncertain if they effectively taught students to succeed in college and were uncertain if they had a positive effect on students learning. The *IEP* overall findings suggest that mathematics instructors' personal teaching efficacy was a more learner-center approach rather than a teacher-center approach.

DEDICATION

My journey has always been guided by Almighty God and supported by my loving family. Thank you to all my loving family and supporting friends for always believing in me and my goals.

ACKNOWLEDGEMENTS

I cannot believe that my journey into earning a Ph.D. has come to an end. It is a bitter sweet closure for this chapter in my life. There are so many people that have supported me throughout my journey that I would like to thank. Almighty God has blessed me in my journey with guidance and a loving support system. I am very blessed and fortunate to have a wonderful support system that always believed in me and my goals. Even in challenging times I could always count on my loving support system to be there for me and back me up. Mom and Dad. Where do I even begin? I am truly blessed to have you both in my life to celebrate this wonderful accomplishment. My parents have always been there for me in good and in tough times throughout my whole life. Your nourishment, love, guidance, and persistence as parents gave me the courage to accomplish my goals. I love you both so much and I sincerely thank you from the bottom of my heart. To my boys I tell you thank you for being wonderful sons. Tony, Eddie, and Nicky, I love you all so much and I hope I have made you all proud. You all are always my light that brightens my day no matter what challenge I am in. My boys gave me the strength to keep going in my journey and made me to never give up. Rosie thanks for giving me the sight in finishing my degree. Gabriel, thank you for always believing in me and assisting me when I needed it. You have helped me at work and when we would have late night discussions about my dissertation. Thank you for lending me your car as well for my safe travels. Love you bro. Diana, thank you for lending me your car for traveling and being understanding with Gabriel assisting me when I needed him. To Mando, for helping me and guiding me from the beginning to the end of my journey. Mando thanks for always being there for me. Also, David for helping me throughout my classes and dissertation. To my best friend, for being there for me when I was all stressed out and for supporting me on the final stages of my dissertation. Thank you for being you. To my wonderful advisors Dr. Mary Margaret Capraro and Dr. Robert Capraro, thanks for supporting me and guiding me on my Ph.D. degree.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Introduction

Merisotis and Phipps (2000) argued that the quality of higher educational enterprise has decreased over the years with the fact remaining that remedial education has been part of this enterprise since early colonial days. In the 17th century, Harvard College assisted unprepared students, by providing tutors in Greek and Latin for those who did not want to study for the ministry (Merisotis & Phipps, 2000). During the 18th century land-grant universities offered preparatory programs for students who had lower than average skills in language arts and mathematics (Payne & Lyman, 1998). During the 19th century, greater than 40% of first year college students were enrolled in developmental courses. When only 238,000 students were enrolled in higher education, over half of the students were placed in developmental courses in Harvard, Princeton, Yale, and Columbia (Merisotis & Phipps, 2000).

Our nation continues to face a crisis at its community colleges. The number of students attending community colleges is increasing, yet most of the students are not prepared for college-level mathematics work. A high percentage of those graduating from high school must enroll in a developmental or basic non-credit mathematics course (Melguizo, Bos, & Prather, 2011). It has been shown that 57% of community students must enroll in developmental mathematics classes before they can enroll in college-level classes (Schwartz, 2007). Nearly 30% of the population in the United States will be Hispanic by the year 2050 (Aizenman, 2008). Reports indicate that 58% of Hispanic students are currently enrolled at 2-year colleges (Snyder et al., 2006). Hispanic students who enroll in community college are academically unprepared or underprepared to engage in college level coursework (Crisp & Amaury, 2010). As a result, the demand for quality developmental mathematics courses is increasing in both community and four-year colleges across the U.S. (National Mathematics Advisory Panel, 2008).

Traditionally, the way community colleges teach developmental courses is sequential, yet many students who are placed in developmental courses (lower-level courses) result in failures never able to register in college algebra. Data has shown that students who take developmental courses either get discouraged or drop the courses completely, failing to pass from one course to the next (Bailey, 2009b). About 67% of community college students are referred to one or more developmental math courses and 33% complete the developmental math sequence (Bailey, Jeong, & Woo Cho, 2010). For example, in New York, as many as 80% of students enrolled in college were required to enroll in at least one developmental course, and 87% of first time incoming students were failing at least one of three basic skills exams (Wright, 1998). In California, campuses have enrolled as many as 90% of first time incoming students into development courses (Hoyt & Sorensen, 2001).

The purpose of this study was to explore whether a web-based technology, *MyMathLab*, made a difference in students' success in both a developmental mathematics course and a subsequent College Algebra course. Additionally, this study examined whether the effect differs by instructors' characteristics contributing to successes or failures of students in developmental mathematics courses.

Technology-Based Programs

Since the early 1960s, educational technologists have been creating computer-based instructional programs. Colleges and universities have been using these computer-based programs for remedial education (Kulik & Kulik, 1991). The inclusion of computer based instructional programs and the current wide availability of internet access has provided an on-line teaching and learning environment which help students address their needs within a high tech atmosphere (Petta, 1998).

In the other hand, technology alone may not be the best was to teach developmental mathematics. An interesting finding from the National Study of Developmental Education was the identification of an inverse association between how much technology was used in a developmental course and the number of students passing the course (Boylan, 2002). Instructors who used full-blown technology instruction alone had a higher rate of failure as compared to those who only used it as a supplemental program (Boylan, 2002). Various technology groups such as the Continuous Quality Improvement Network (CQIN) and the American Productivity and Quality Center (APQC) reported in their benchmarking study that using technology in conjunction with individual drill and practice and supplementary assistance yielded better student results (Boylan, 2002). Therefore, students who used technology alone may not succeed any better than students who receive only traditional instruction. Thus, technology alone may only frustrate and confuse students, creating another barrier to their success.

Technology can serve as a barrier for certain developmental students. Saxon and Boylan (2001) suggested that students participating in remedial courses may be very much like other community college students but differ in important ways when it comes to how they learn. McCabe (2003) believed that developmental students have had little or no access to technology outside of the school setting and may be afraid and perhaps reluctant to use it, which may account for why technology alone may not be a viable solution. Therefore, the goal of combining technology into developmental mathematics courses should be to allow students more choices in terms of "where, when, and how they learn mathematics and not as the primary source of instruction" (Kinney & Robertson, 2003, p. 316).

Technology web-based programs can help students succeed in developmental programs. Boylan (2002) pointed out that computer based programs were effective when they provided tutoring, review, and supplemental exercises for developmental students. McCabe (2003) similarly acknowledged that using a developmental technology program can bolster student learning and can serve as a positive influence on instructors' skills with when working with underprepared students. Aichele, Francisco, Utley, and Wescoatt (2011) also found that some colleges and universities use self-paced systems such as ALEKS (Assessment and Learning in Knowledge Spaces) and *MyMathLab* as the main teaching tool in developmental and college algebra classes. Taylor (2008), therefore, found that students had significant gains in algebra achievement when participating in a web-based intermediate algebra course using ALEKS. While Spence (2008) showed student's success using the video tutor component of *MyMathLab* in traditional lecture classroom settings. The use of computer-based instruction at 123 colleges and universities had several positive effects including: a) more student learning in less time, b) slightly higher grades on post-tests, and c) improved student attitudes toward learning (Kulik & Kulik, 1986).

Effective Teaching and Teacher Characteristics

Students tend to learn when they have effective teachers and shown to have positive effects on student learning. Hattie (2003), therefore, found in examining 800 meta-analysis with over 50,000 studies, different approaches have been taken in education that have positive effects on student learning, yet the most effective approach was excellence in teaching. Many teaching and learning variables were examined, yet the magnitude of effects was small when contrasted to the teacher effect, i.e. quality teaching is the single most significant on student achievement (Rowe, 2003). Smittle (2003) pointed out, “research findings of successful developmental education programs and general principles of effective practice in teaching offer strong foundation in the search for teaching excellence in developmental education” (p.1). Boylan and Bonham (1998) conducted a study in Improving Developmental Education: What We’ve Learned from 30 years of Research, and found that 8 out of 20 characteristics focused directly on effective teaching and effective pedagogical strategies for teaching: variety of teaching methods, sound cognitive theory based courses, computer-based instruction, classroom/laboratory integration, developmental course exit standards, strategic learning, professional training for faculty and staff who work with developmental students, and critical thinking.

Effective teachers using computer-based instruction enhanced student's grades performance. For example, Burch and Kuo (2010) conducted a study on the difference between paper homework and MyMathLab homework on student achievement in college algebra. The study was spread across two semesters. Paper homework was used during the first semester and MyMathLab was used for homework during the following semester. The results of the study showed that students using MyMathLab performed better on tests and the final exam. Also, Buzzetto-More and Ukoha (2009) conducted a study at the University of Maryland Eastern Shore (UMES) in which they examined student satisfaction, persistence, and achievement after implementing MyMathLab in all remedial mathematics courses. The student performance data showed a statistically significant decrease in student withdrawal rates and a significant increase in pass rates for the course (when compared to semesters prior to implementing MyMathLab).

There are other measures to assess a teacher's quality determining what makes an effective teacher. Minor, Onwuegbuzie, Witcher, and James (2002) described being an effective teacher as one who was, "knowledgeable, self-confident, and enthusiastic [motivated], with strong communication and management skills, clear instructional focus, and high expectations of self and students…" (p. 117). Additionally, Walker (2010) defined an effective teacher as one who significantly impacted students' lives and was successful in helping students learn. Minor et al. (2002) pointed out that effective teachers have high mental skills, are subject area content specialist with strong pedagogical skills, manage their instructional time wisely, and are able to differentiate instruction. Minor et al. (2002) also described effective teachers as ones who, "are creative, encourage active student participation, make relevant assignments, arrange for plenty of successful engaged time, are skillful in using questions, promote critical and creative thinking, and use wait time when seeking student response…provide feedback, monitor programs and student progress, use both traditional and alternative assessment, and are fair in assessment and grading procedures…" (p. 117).

Based on this literature review, it is expected that a technology web-based *MyMathLab* program might make a difference in student's success in developmental and college algebra courses and that certain instructor characteristics might contribute to successes or failures in early college mathematics courses.

Methods

This study was conducted at a predominantly Hispanic South Texas community college. The selected participants (n = 200) consisted of students who were formally enrolled in developmental-level mathematics classes (Math0375 and Math0376) and a College Algebra class (Math1314) from 2001 to 2012. The students' ranged in ages from 20 to 65 and were diverse in gender. The pool of students in my study will only be Hispanic students because that is the predominate (over 95%) population in this college on the U. S. border. A random sampling of at least 20 students from ten different years (2001-02, 02-03, 03-04, 04-05, 05-06 & 08-09, 09-10, 10-11, 11-12 and 12-13) were used for this study to cross sample students who were enrolled in *MyMathLab* (after

2005) and those prior to the adoption of *MyMathLab* (before 2005). To allow for transition and to ensure the intervention was in place, the years of 2006-07 were omitted from the study. Thus, at least 100 students were selected for each group for a total of approximately 200 participants.

Description of the Developmental Mathematics Classes and College Algebra

Math0375 Pre-College Mathematics I and Math0376 Pre-College Mathematics II are developmental courses offered at a border town community college. Math0375 includes topics of fundamentals concepts, linear equations and inequalities, polynomials in one variable, factoring and rational expression. Math0376 includes topics of relations and functions, polynomials, rational expressions, and quadratics with an introduction to complex numbers, exponential and logarithmic functions, determinants and matrices, and sequences and series. Math1314 College Algebra includes topics quadratics, polynomial, rational, logarithmic, and exponential functions, systems of equations, Progressions, sequences and series, and matrices and determinants.

Data Analysis

Student success in developmental mathematics courses was measured by pre and post *MyMathLab* tests in addition to grade distributions from 2001 and 2005 (before *MyMathLab*) across the two developmental courses and a college algebra course and the implementation of *MyMathLab* between 2008-2012 to determine if using *MyMathLab* had an impact on student success in two developmental courses and an early algebra course. Also, the instructors will complete two surveys. *The Mathematics Teaching Efficacy Belief Instrument* (MTEBI) (see Appendix A) and *Instructors Educational Philosophies* (IEP) (see Appendix B). The survey questions were compared to the results to determine if the instructors' characteristics had an impact on student's achievement in developmental courses enhanced by *MyMathLab*.

Research Questions

The following research questions guided this study:

1A) What was the success rate for students who take Math0376 before *MyMathLab* (2001-2005) as measured by grade distribution?

1B) What was the success rate for students who take Math0376 with *MyMathLab* (2008-2012) as measured by grade distribution and pre and post *MyMathLab* tests?

2A) What was the success rate for students who take Math0376 before *MyMathLab* and who earned an A, B, or C in Math0375?

2B) What was the success rate for students who take Math0376 with *MyMathLab* and who earned an A, B, or C in Math0375?

3) Does the traditional developmental math course or the course enhanced with *MyMathLab* have a higher success rate for students who enroll in college algebra (Math1314) (range of what can be earned A, B, C, D, F, or W)?

4) What instructor characteristics as determined through two surveys may contribute to student successes or failures in these developmental and college algebra classes?

Collection of Data - Instruments

Student success in developmental mathematics courses were measured by pre and post *MyMathLab* tests in addition to grade distributions from 2001 and 2005 (before *MyMathLab*) across the two developmental courses and a college algebra course and the implementation of *MyMathLab* between 2008-2012 to determine if using *MyMathLab* had an impact on student success in developmental and an early algebra course.

Quantitative data were collected through two instruments with 18 full-time instructors. The instruments helped gather information to depict the philosophies and efficacies associated with instructors who have a large number of students demonstrating exceptionally high performance or exceptionally low student performance in developmental classes using *MyMathLab*. The survey results were compared to the students' results to determine if the instructors' philosophies and efficacies had an impact on student's achievement in developmental courses enhanced by *MyMathLab* and a subsequent College Algebra course.

The initial data were analyzed by removing those students who were not completely committed to *MyMathLab*. Extant data consisting of number of attempts before a correct response were used to exclude students who did not fully absorb the intervention. Therefore, a ratio of correct responses to incorrect responses, for 1:3 or greater were considered committed to the intervention whereas 1:5 or smaller were considered a lack of commitment to the intervention and extensive guessing. Pre and post data for *MyMathLab* were collected from all participants to determine generalized growth from participating in the enhanced Math 0376 course. Grades for students in both groups were collected for Math 0376 and Math 1314 for comparison purposes. The data were analyzed using a paired-samples *t*-test, effect sizes, and confidence interval.

2. LITERATURE OF REVIEW

Introduction

This section contains literature and research related to broad topics including: developmental education, effective teachers, personalized tutoring, and computerized individualized curriculum as shown in Figure 1 and Figure 2. Also, the review of literature addressed the growing number of Hispanic students arriving at colleges with less than adequate mathematical ability and unprepared for college level work. Finally, studies on technology and teacher effectiveness and its effect on predicting success were reviewed.

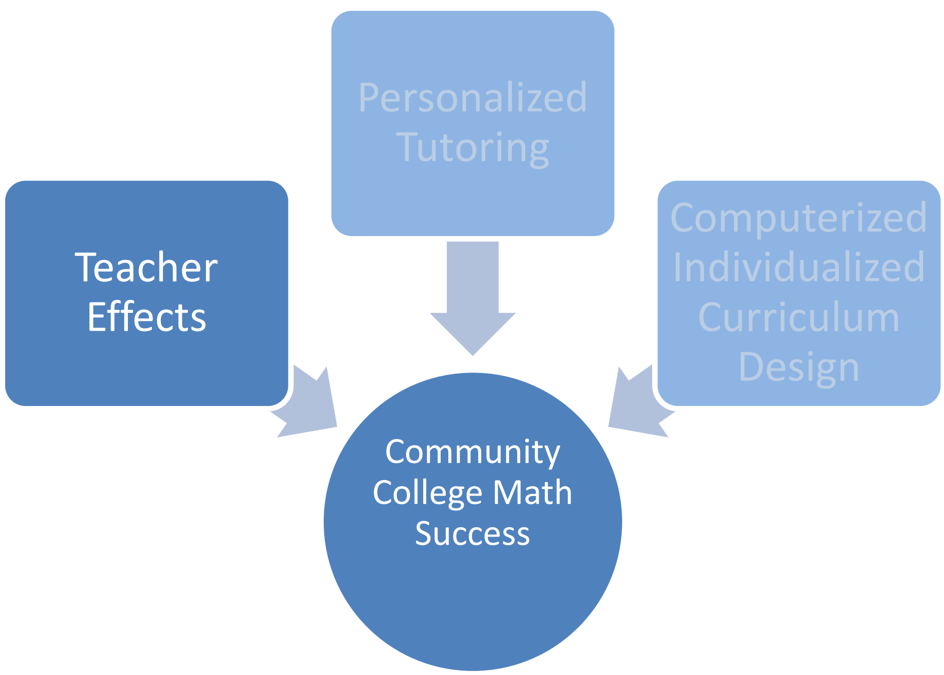


*Figure 1***.** Traditional instructional model.

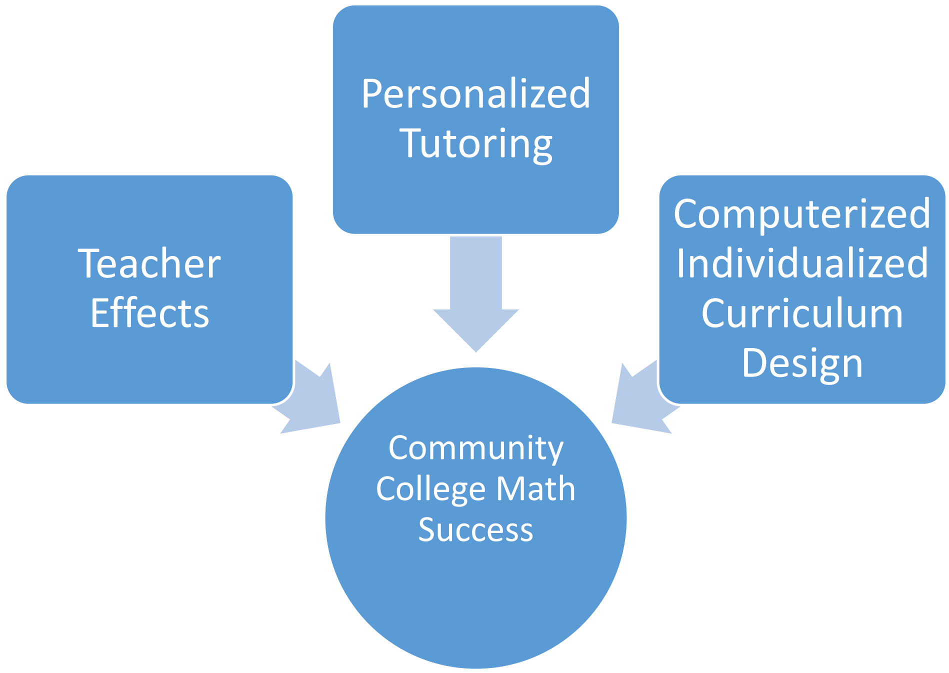


Figure 2. Graphic for college math success through developmental education.

Developmental Education

Every year over 2,000,000 students enroll in developmental education courses in U.S. colleges and universities (Bonham & Boylan, 2011). For instance in fifteen community colleges in six states, Perin and Charron (2003) examined students' academic readiness and the colleges' assessment and placement policies using a qualitative, instrumental case study. The results showed that several students were enrolling in community colleges unprepared for postsecondary study. Consequently, the study compared the use of educational learning centers to developmental education for increasing student preparedness for postsecondary curriculum (Perin & Charron, 2003).

Students' enrollment in developmental education classes consequently is costing taxpayers more money to teach students academic skills in college that should have been learned in high school. Developmental students in fact are exhausting their financial aid in developmental courses. Saxon and Boylan (2001) admittedly examined and analyzed the research literature regarding the cost of delivering developmental education at the institutional level. Therefore, results showed that a small amount of money is being spent to raise academic standards for a large amount of students enrolling in higher education at the developmental level. Still, developmental courses are costing colleges more than they produce in revenues (Saxon & Boylan, 2001).

Several developmental students as a result are delayed from graduating from college due to lack of preparation and spending too much time on developmental courses before enrolling in college-level courses. Whereas, through a U.S. Federal Title III-A grant, Gallard, Albritton, and Morgan (2010) developed and implemented a cost and benefit model in one community college in Florida to calculate a return on the investment from a specific developmental education program to increase course completion rates and student retention through an enhanced tutoring program. The results of the cost and benefit model of the intervention showed a large return on the investment in the developmental education program. Consequently, in the college developmental education program, early successful intervention helps students, the institution, and society succeed all together (Gallard et al., 2010).

In higher education, therefore colleges are investing in developing developmental education programs for students to succeed. Brothen and Wambach (2004) actually reviewed research and suggested that those involved in developmental education redefine their core principles and strengthen their key concepts in theory and practice in the field. The results therefore showed that in order to meet remedial students' needs in college developmental education programs across the nation, developmental educators need to a) renew their focus on literacy skill development, b) encourage students, c) review placement testing procedures, d) be adaptable, e) understand theory, f) integrate across subject areas, and g) find educators who possess a vision for their programs and a mission for students to succeed (Brothen & Wambach, 2004).

Developmental education in fact plays a vital role among community colleges' curricular missions. Kozeracki and Brooks (2006) for instance examined the developing role and organization of developmental education at community colleges such as a) the role that faculty from all disciplines must use if unprepared students are to succeed, b) changes in faculty attitudes about developmental education policies, and c) effective assimilations of developmental education into the culture, mission, and institution. The results accordingly showed that there are extensive institutional provisions for developmental education programs such as a) reliable administrative support, b) sufficient financial resources, and c) widespread faculty involvement. Consequently, this improved the outcomes of students who needed the assistance and support that community colleges provided for students to succeed (Kozeracki & Brooks, 2006).

In the same way, Fowler and Boylan (2010) claimed that students who are academically deficient and underprepared in all subject areas encounter both many academic and nonacademic challenges in their coursework in higher education and personal issues that construct barriers for success. These results suggested that a structured developmental education program that identified and addressed students' academic, nonacademic, and personal issues can benefit students who required developmental education coursework in all subject areas and can positively affect student success and retention (Fowler & Boylan, 2010).

Developmental Courses

Developmental education is one of the major problems that community colleges are encountering in our nation. The majorities of the students that enroll at community colleges are unprepared and are being taught college-level material. Yet, community colleges are addressing these problems with different practices and programs to help the unprepared students succeed in higher education college-level courses. Therefore, Bailey (2009a) provides a national framework in how unprepared students accomplish college-level courses in community colleges and includes data collected across the country about students who take developmental courses, the sequence of their courses, and the challenges they face when completing their courses, as well as programs and practices that are helping unprepared students succeed and meet their goals. The results show that unprepared students are not progressing in developmental education courses; therefore, the students would have done the same if they would have been placed in college-level courses without spending money and time in developmental courses (Bailey, 2009a).

Developmental students admittedly are not completing developmental courses and are not able to move into college-level courses, so how do institutions know if their college developmental programs are effective in remediating students? Evaluation of developmental programs should not only be determined by whether these courses are effective. Weissman, Bulakowski, and Jumisko (1997) therefore examined the placement of remedial students, the timing of remediation, and the measures of effectiveness while the students are enrolled in college-level courses. The results showed and suggested that the following policies will lead to higher levels of performance, persistence, maximum effectiveness, and enhanced success for developmental students: Students should a) be required to enroll in a program of developmental education, b) be required to begin their developmental education program on initial enrollment, and c) be allowed to enroll in college-level courses concurrently with developmental courses (Weissman et al., 1997). As a result, students entering community colleges are assessed and are being placed in one or more different levels in developmental education non-credit baring courses. Little research has been conducted on monitoring these students' progressions through multiple levels of developmental education courses and into entry-level college courses.

Community colleges while yet have the open-door admission policies for students, including those who are academically underprepared, to enroll into. Based on standardized placement-test scores, students may possibly concurrently enroll in developmental courses and college-level courses unrelated to the area in which they are considered to be academically underprepared. Illich, Hagan, and McCallister (2004) therefore evaluated the assumption that a student's under-preparedness is limited to a specific area by assessing the college-level courses. The results showed that developmental students who chose to concurrently enroll in college-level courses not related to their developmental courses struggled in these courses, and students who did not successfully complete their developmental courses under-preformed in their college-level courses (Illich et al., 2004).

Therefore, the traditional practice of placing students into remedial courses based on a single score on a cognitive exam instrument is efficient, yet it might not be effective (Boylan, 2009). Therefore, students deficient in certain skills take about a year or more to complete developmental courses. Boylan (2009) suggested a theoretical model referred to as *Targeted Interventions for Developmental Education Students* that will provide an alternative for assessing, advising, and placing developmental students in colleges. This model will allow colleges to place unprepared students more accurately and effectively and to provide other students with particular services and support to contribute to their success in higher education.

Developmental education while yet acts like a gatekeeper in colleges, and some students that cannot complete developmental courses end up dropping out of college or are academically terminated. Attewell, Lavin, Domina, and Levey (2006) admittedly examine and explore the effects of taking remedial courses on graduation rate; the consequences of taking too many remedial courses; the significance of different types of remediation; and the effects of successful completion of remedial coursework on degree completion. The result shows that most of the gap in graduation rates has nothing to do with taking developmental courses in college. Consequently, taking developmental courses was not associated at all with lower chances of academic success, even for students who took three or more developmental courses (Attewell, et al., 2006).

Community colleges across the nation yet play an important role in providing students with affordable higher education. In three community colleges in three different states Bremer, Center, Opsal, Medhanie, Jang, and Geise (2013) explored student outcomes related to taking developmental English and mathematics courses and examined the outcome trajectories of students at each college in view of their enrollment in developmental courses during their first term along with other variables such as age, gender, ethnicity, financial aid, occupational versus non-occupational major, tutoring, and placement scores. The results showed that math placement testing is a beneficial predictor, but developmental courses did not help raise students' GPAs. Consequently, financial aid and tutoring were considerably more clearly related to student success than developmental coursework (Bremer et al., 2013).

Therefore, Bailey, Jeong, and Woo Cho (2010) although analyzed their patterns and the determinate of student progression through sequences of developmental education starting from initial referral to reduce developmental students from failing and withdrawing from developmental courses. Results show that more students exited their developmental sequences because they did not enroll in the first or a subsequent course than because they failed or withdrew from a course in which they were enrolled (Bailey et al., 2010).

Developmental Mathematics

Developmental education has become part of a national debate in higher education, especially in the subject area of mathematics (Bonham & Boylan, 2011). In mathematics, there has been an especially large increase in retention and failure. Students continue to fail developmental courses, and these courses are becoming barriers for students to succeed or continue onto college-level courses. Therefore, there are a number of projects to redesign and improve the delivery of the content of developmental mathematics courses (Bonham & Boylan, 2011). Developmental mathematics courses have the highest rates of failure; thus, students are not succeeding in the subject area of mathematics, which prevents them from achieving their educational goals (Bonham & Boylan, 2011).

Furthermore, students in developmental mathematics courses are having difficulty completing and passing developmental mathematics courses. Unfortunately, not many of the students that enroll in the full sequence of recommended developmental mathematics courses succeed in completing the courses (Bonham & Boylan, 2011). The majority of colleges report that it takes students about a year to complete their developmental education courses (Boylan, 2009). Therefore, courses which were formerly designed to encourage student academic success now often serve as barriers to that achievement (Bonham & Boylan, 2011).

Research in the past has shown that students are entering colleges unprepared, yet many colleges allow these students to decide the timing of their enrollment in developmental mathematics courses. Fike and Fike (2012) found that a policy requiring mandatory enrollment during the first semester for developmental math students may be in the best interest of students and colleges. The results shows that further research is needed to better inform policy regarding the timing of required placement of students in developmental mathematics courses (Fike & Fike, 2012).

There has also been an increase in the enrollment of students in higher education courses, but also there has been an increase in unprepared students enrolling in developmental mathematics courses. These unprepared students are weak in mathematics content knowledge and also lack the skills for academic success (Xu, Hartman, Uribe, & Mencke, 2001). Therefore, developmental education program leaders are being pressured to find ways for these students to succeed. Mireles, Offer, Ward, and Dochen (2011) discuss the effectiveness on academic success of incorporating study strategies in a developmental mathematics and college algebra program. The results showed that a student increased in the Learning and Study Strategies Inventory (LASSI) scales in study strategy usage and were supported by comments students made on open-ended surveys (Mireles et al., 2011).

Students entering community colleges yet are being placed into sequential remedial courses based on placement test performance. Therefore, developmental mathematics becomes a primary barrier for students ever being able to complete a post-secondary degree (Stigler, Givvin, & Thompson, 2010). The findings from Stigler et al. (2010) revealed two types of data: students' understanding of basic mathematics, and student perceptions of what they believed it meant to do mathematics. Therefore, Stigler et al. (2010) found that : a) students' knowledge of mathematical concepts may be fragile while their knowledge of procedures is firmly rooted; b) students can apply appropriate reasoning under the right conditions, but that form of knowledge is rarely accessed; and c) students are able to provide conceptual explanations and produce correct answers. These results suggest that students should be encouraged to draw more extensively on their extant conceptual reasoning.

Rapid Review therefore is an intense and inexpensive program that targets students' strengths in mathematical skills and basic knowledge before enrolling in a mathematics course. Rodgers, Posler, and Trible (2011) objective for this initiative was to decrease the amount of time students spend studying developmental mathematics, while not decreasing their chances for success in subsequent mathematics courses. The results showed that students needing a review in basic algebra concepts can benefit and succeed in their mathematics courses from this intensive, self-paced review program. Consequently, students had the opportunity to save a semesters' worth of time, tuition, textbook, and costs of the class (Rodgers et al., 2011).

Many students yet are finding it necessary to enroll in remedial mathematic programs in higher education. In 107 community colleges with a total enrollment of 85, 894 freshmen, Bahr (2008) analyzed data using hierarchical multi-nominal logistic regression to compare the long-term academic results of students who achieved college-level mathematical skills without remedial support, thus testing the efficacy of remedial mathematic programs. The results showed that students who remediate successfully achieved college-level mathematical skills compared to students who successfully passed college-level mathematics without the need for remedial support (Bahr, 2008).

College remediation therefore is reported to be too expensive and is an unfortunate role for higher education. Aycaster (2001) investigated and determined the effectiveness of developmental mathematics courses in preparing developmental students for college-level work and their influence on the success of certain pedagogical factors. The results showed that colleges need to offer at least two styles of instruction for developmental mathematics courses and that the retention rates for developmental students are higher than the retention rates of non-developmental students. Students who took developmental courses in such settings succeeded in college level courses, which validated that developmental courses were serving their purpose (Aycaster, 2001).

Hispanic Students in Higher Education

There are several definitions for diversity in higher education. Ethnic diversity in the classroom is one of the positive key factors in the success of developmental education among minority students in colleges. Some educators view diversity in developmental education courses as being a downfall for minority students. Boylan, Sutton, and Anderson (2003) proposed methods for increasing minority students' retention and enhancing students' intellectual development by enrolling minority students with students of different ethnic backgrounds. The results showed that diversity should not be viewed as a problem for minority students but as a key factor for learning and succeeding in developmental education (Boylan et al., 2003).

There is a great diversity of students in community colleges. Wolfle (2012) examined the fall-to-fall persistence and academic success of developmental students in a Virginia community college based on age and ethnicity. The results show that the developmental status of students is not a significant factor in either the success in the first college-level mathematics course or in fall-to-fall persistence (Wolfle, 2012).

Immigrant children are increasing and make up a large portion of our nation's population and a significant portion of the U.S. workforce. Teranishi, Suarez-Orozco, and Suarez-Orozco (2011) explored how community colleges can assist immigrant students more effectively through open admissions, accommodations for students who work or have family responsibilities, and affordable postsecondary education. The results showed that the research community needs to work more closely with community colleges to evaluate and assess the effectiveness of efforts to increase the educational achievement and degree completion of immigrant students to contribute to our nation's workforce (Teranishi et al., 2011).

Hispanic students are not well prepared by the time they enter college. By the year 2050, estimates predict that close to 30% of the U. S. population will be Hispanic (Aizenman, 2008). Therefore, these large numbers of individuals will need to prepare for and succeed in higher education. Crisp and Amaury (2010) examined the impact of a set of theoretically-derived predictor variables on the persistence and transfer of Hispanic community college students and found three major conclusions regarding Latina/o success: a) a common set of factors impacted different measures of success for students enrolled at 4-year institutions that are substantiated for Hispanic developmental and non-developmental community college students; b) influence of environmental pull-factors were important for both developmental and non-developmental students, substantiating the need for additional financial support for Latino students entering college; and c) some identified set of variables might be impacting developmental students' success beyond the first 2 years, such as institutional policy surrounding developmental students.

Gender Differences in Using Technology

Much research exists in the role of gender differences in using technology to supplement learning (Kahveci, 2010). In some previous studies, researchers found that implementing technology for learning was a dominant activity and had more positive effects on attitudes for males than for females (Kahveci, 2010; Li & Kirkup, 2007). When females were given the same equal access opportunity to use computers as males, females were less likely to use computers than males because females viewed the use of technology for learning as a more predominately male activity (Hwang, Suk, Fisher, & Vrongistinos, 2009; Kirkup, 1995). Also, mathematics has been viewed as a male dominated and male oriented subject (Kogelman & Warren, 1978). In contrast other researchers found that females perceived themselves as being the same as males in the technology culture (Comber & Colley, 1997). Research has also indicated that males and females did not differ in terms of mathematical achievement when it came to grade performance (Gliner, 1987; Hembree, 1990; Ma, 1999; Perez, 2012). Thus, females do extremely well in male-dominated subjects like using technology for learning (Hwang et al., 2009; Jonier et al., 2011).

Effective Teachers

Students with developmental needs in college continue to be underprepared compared to regular college-level students. Exploring effective teaching methods for students with developmental issues in college extends beyond basic cognitive issues to addressing non-cognitive needs for these students (Smittle, 2003). Thus, these students present challenges to developmental education educators that often far exceed those presented by college-ready students. The six principles for effective teaching presented by Smittle (2003) are the product of integrating findings from successful developmental education programs and general principles for effective teaching in undergraduate education. These principles will help better prepare educators in their quest to assist students in meeting their goals in college: 1) commit to teaching underprepared students, 2) demonstrate good command of the subject matter and the ability to teach a diverse student population, 3) address non-cognitive issues that affect learning, 4) provide open and responsive learning environments, 5) communicate high standards, and 6) engage in ongoing evaluation and professional development.

Finding new pedagogical strategies to help unprepared students succeed when they enter college and enroll in developmental mathematics courses are underway now more than ever before. There are several different types of innovations for helping developmental students succeed in developmental mathematics programs such as a) corequisite models, b) accelerated learning techniques, and c) technology centered methods (Mireles, Westbrook, Ward, Goodson, & Jung, 2013). Another type of program is to examine the impact on grade outcomes and self-efficacy for the integration of preparation-homework with the intention of introducing content that has never been taught in developmental mathematics courses. Mireles et al. (2013) found that students who reported doing preparation homework significantly outperformed other students and had higher self-efficacy. The results show that the students who completed the preparation -homework regularly felt better prepared for the next day's class compared to other students but further investigation is needed to assess its effects.

A large amount of research about supplemental instruction has been conducted in several colleges and has been found as being successful in developmental courses. More than 30 years of research and practice have been done on the success of developmental courses, yet supplemental instruction is a more recent educational improvement and further investigation is needed. In 90 developmental mathematics courses, Wright, Wright, and Lamb (2002) gathered and analyzed data concerning the effects of using supplemental instruction. The results showed that additional research is needed to determine if supplemental instruction models can significantly impact developmental mathematics courses (Wright et al., 2002).

Several programs in community colleges offer different support services for developmental students to succeed. Roselle (2008) examined community college library practices and resources used in helping developmental students succeed in developmental education. The results and research showed that community colleges across the country are using library resources to help developmental students by a) integrating basic library skills, b) academic success courses, c) library sessions, d) class assignments with learning assistance and tutoring, and e) reducing library anxiety to help build student confidence (Roselle, 2008).

Different teachers hold different characteristics in delivering instruction to students in higher education. Therefore, students learn more and succeed from teachers with certain characteristics. Highly qualified teachers possess certain common characteristics. Thompson, Greer, and Greer (2004) examined and found that students indicate that there are twelve common characteristics of highly qualified teachers: a) fairness, b) positive attitude, c) preparedness, d) personal touch, e) sense of humor, f) creativity, g) willingness to admit mistakes, h) forgiving, i) respect, j) high expectations, k) compassion, and l) sense of belonging. Students conceptualized these twelve characteristics as good teaching and are necessary for them to be able to learn from these teachers. The results showed that teachers who possess these traits increased students' achievement level in higher education and their students had a positive and successful school experience (Thompson et al., 2004).

Because there has been a high failure rate in mathematic courses in higher education, math instructors need to find new approaches and strategies to teach different learning styles for unprepared students. Among the many theories attempted to improve different learning styles for unprepared students is the left-brain/right-brain (LB/RB) theory. Kitchens, Barber, and Barber (1991) reviewed the professional literature concerning LB/RB learning theory and focused on students who possessed problems learning mathematics. The results showed that understanding how unprepared students' natural way of thinking relates to their past difficulties. This approach offered students a successful approach to learning mathematics and provided math instructors with an enriching enhancement for teaching (Kitchens et al., 1991).

Pass rates of developmental education students reach almost 60 percent in higher education nationwide. Mellow, Woolis, and Laurillard (2011) described projects that placed faculty and pedagogy at their center and that aimed to understand and improve the teaching of developmental education by evidence-based and theory-driven motives that can reveal pedagogical patterns, particularly on community colleges. The results showed that pedagogical patterns provided faculty with a template to evaluate their own practice in the classrooms. Consequently, it helped faculty to improve their own effectiveness and led to the improving of student outcomes (Mellow et al., 2011).

For several years, community colleges have been the main institutions offering developmental mathematics courses. A developmental mathematics instructor at a community college, Galbraith and Jones (2008) discussed his teaching research-based literature and personal experiential reflectivity. These researchers created an organizing framework for understanding the artistic and mechanic elements of effective developmental mathematics instruction with adult learners. The results showed that the teaching perspective encompassed both mechanical and artistic elements that helped students succeed to investigate ideas and use math skills with experiences significant to real-life situations (Galbraith & Jones, 2008).

Community colleges play an important role in offering developmental courses to unprepared students in higher education. Supplemental Instruction (SI) has become an important role in community colleges as an academic support program used to aid student performance, retention, and academic success. Phelps and Evans (2006) examined the utility of SI that created a climate of achievement for learners in developmental mathematics courses. The results showed that SI improved the grades of minority students, used academic group work to build connections between students, and created a climate of achievement (Phelps & Evans, 2006).

Developmental education programs in higher education are designed to help academically underprepared students enculturate into college and increase student retention. The impact of developmental mathematics programs on student retention has been debatable in higher education among administrators, policy makers, and faculty. In order to determine the effectiveness of developmental mathematics programs in retaining students, Lesik (2007) applied a regression-discontinuity design within the framework provided by discrete-time survival analysis. The results showed that developmental mathematics courses had a positive impact on student retention and suggested to policy makers that developmental education programs can be effective and successful in helping students stay enrolled in higher education (Lesik, 2007).

Mathematic courses cause more anguish for students in colleges than any other subject area. At Boise State University, Belcheir (2002) examined the understanding of students enrolled in intermediate algebra to uncover pre-enrollment variables and course variables, which predicted success in the course. The results showed that the early part of the course is critical to student success; therefore, instructors should be more direct with their students at the beginning of the intermediate algebra course. However, very few of the course-related variables on how the class was structured or managed were significant (Belcheir, 2002). Consequently, more research still needs to be done in understanding how students can be successful in mathematics course requirements in college.

Teachers have different teaching characteristics, and the students in their classrooms have different learning styles. Stronge, Ward, Tucker, and Hindman (2007) examined what established effective teaching as defined by measured increases in student learning with an emphasis on the instructional behaviors and practices. The results showed identification of instructional characteristics and behaviors of those teachers who produced high gains in student learning. Consequently, the study helped educators to understand the links between classroom processes and necessary student outcomes (Stronge et al., 2007).

In K-12 education, policymakers are searching for different ways to improve education by focusing on characteristics of teachers. Wayne and Youngs (2003) systematically examined studies on the relationship between student achievement improvements and the characteristics of teachers and described this relationship through four categories of teacher characteristics: college ratings, test scores, degrees and coursework, and certification status. The results showed that students learn more from teachers with certain characteristics. For example, a positive relationship exists between test scores and college ratings; and within the categories of degrees, coursework, and certification students clearly learn more from teachers with certification in mathematics, degrees related to mathematics, and coursework related to mathematics (Wayne & Youngs, 2003).

Colleges are using small-group instruction to engage developmental students in basic algebra. Using a quasi-experimental study, DePree (1998) investigated the impact of small-group work on adult preparatory algebra students' assurance in mathematical skill and attainment in basic algebra. The results showed that cooperative small-group methods became an integral part of adult mathematics courses. Consequently, the small-group methods provided a supportive learning environment where students communicated their understandings of mathematical concepts and had a positive impact on the completion rate (DePree, 1998).

Several colleges are piloting different types of methods to teach developmental mathematic courses. Using four different pedagogies to teach a lower remedial mathematics course at University of Illinois at Chicago, Baxter and Smith (1998) examined students' grades in subsequent mathematics courses. The results showed that the two pedagogies involving traditional lecture and lecture-discussion led to higher grades in subsequent courses compared with the other two pedagogies from the classical model (Baxter & Smith, 1998).

Teacher Efficacy Beliefs

Over the past ten years, several efficacy belief instruments have been established by transforming the original Science Teaching Efficacy Beliefs Instrument (STEBI-A). Through factor analysis, Enochs, Smith and Huinker (2000) established factorial validity of the recently developed Mathematics Teaching Efficacy Beliefs Instrument (MTEBI) for pre-service elementary teachers. The results show that the METBI is a valid and reliable assessment of mathematics teaching, self-efficacy, and outcome expectancy. Consequently, the validation of instruments continues to be a work in progress (Enochs et al., 2000).

Korkmaz (2011) developed a scale designed to detect the level of pre-service teachers' application from teaching materials based on their perception of self-efficacy. To detect the validity of the scale, exploratory and confirmatory factor analyses and item discriminations were piloted. To detect the reliability, a level of internal consistency and the consistency level were calculated. The results showed that the scale is valid and reliable and can be used in the measurement of self-efficacy perception levels of pre-service teachers' utilization of teaching materials (Korkmaz, 2011).

In low socio-economic schools, Latino populations remain academically engaged despite difficult situations they encounter. Sosa and Gomez (2012) explored the connection of teacher self-efficacy beliefs in supporting student flexibility to teaching practice and support of Latino students. The results showed that teachers' sense of efficacy is supported by their belief that behavior is intensely predicted by perceived self-efficacy and the sensitivity that teachers demonstrated around the stressors that Latino students encounter (Sosa & Gomez, 2012).

Several studies have been using the mathematics teaching efficacy beliefs for pre-service elementary teachers. Using Bayesian item response theory, Kieftenbeld, Natesan, and Colleen (2011) provided a detailed analysis of the psychometric properties of the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI): validity of the scoring procedure and measure measurement accuracy for teachers with different efficacy levels. The results showed that three factors were identified that weaken the MTEBI test reliability and validity: scale, wording, and placement of the items (Kieftenbeld et al., 2011). These areas need revisions to make the MTEBI more reliable and valid.

Teachers' beliefs, attitudes, and behaviors are significant for understanding and refining the learning process. Using the Mathematics in Science Self-efficacy Scale (UMSSS) instrument, Can, Gunhan, and Erdal (2012) collected data from 250 pre-service science teachers measuring their self-efficacy toward the use of mathematics lessons. The content and construct validities results showed consistency between the purpose and the items of the instrument and internal consistency of the scores. Consequently, the generated scale was a valid and reliable instrument (Can et al., 2012) for their pre-service teachers.

To influence student learning, educational psychologists suggest that a teacher's quality of performance and commitment to work are connected to their level of motivation. Ware and Kitsantas (2007) examined whether teacher and collective efficacy beliefs predict commitment to the teaching profession. They also developed two teacher efficacy scales, a collective teacher efficacy scale and a teacher professional commitment scale. The results showed that the scales significantly predicted teacher professional commitment and significantly predicted the retention of teachers in the profession. Consequently, the scales demonstrated satisfactory construct validity and reliability (Ware & Kitsantas, 2007).

The Teacher Sense of Efficacy Scale (TSES) revised by Nie, Lau, and Liau (2012) examined the factorial, predictive, convergent and discriminant validity and also its internal consistency reliability. The results showed that there were high correlations between teacher efficacy beliefs and teaching strategies indicating that the TSES had good predictive validity and there were correlations between the efficacy beliefs. Additionally, the correlations between the strategies were higher than the correlations between the efficacy beliefs and strategies indicating good convergent validity. Also, the TSES had good internal consistency reliability (Nie et al., 2012), yet the discriminant validity was weak.

In assessing educational programs in higher education, it is important to assess pre-service teachers' efficacy beliefs about their pedagogy. In a Midwestern university located in a mid-sized town, Rethlefsen and Park (2011) explored and determined if specific pedagogy methods from the BAR model led to positive changes in a total of 297 pre-service teacher efficacy beliefs using the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI). Using a mixed-methods approach, the results showed positive changes on every item on the MTEBI for the pre-service teachers' efficacy. The results also showed possible links between efficacy beliefs and the pre-service teachers' grades, as a result of their field experiences (Rethlefsen & Park, 2011).

In a Midwestern University, Bates, Latham, and Kim (2011) examined 89 early childhood pre-service teachers' mathematics-teaching efficacy and compared them to their mathematical performance using the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI), Mathematics Self-Efficacy Scale (MSES), and the Illinois

Certification Testing System (ICTS) Basic Skills Test. The results showed that pre-service teachers' mathematics self-efficacy was positively correlated to their personal mathematics-teaching efficacy. Consequently, their mathematical performance was linked to their mathematics self-efficacy and mathematics teaching efficacy (Bates et al., 2011).

Technology in the Classroom and Personalized Tutoring

Several students entering college are unprepared to start college-level mathematics courses. Developmental mathematics courses in colleges have been taught traditionally for years. Spradlin and Ackerman (2010) analyzed the difference between the academic performances of students taking a developmental mathematics course using traditional instruction as compared to students in classrooms supplemented with computer-assisted instruction. Therefore, using technology is a new pedagogical strategy for delivering instruction and improving students learning through an active learning environment (Spradlin & Ackerman, 2010). Computer–assisted instruction increased students' opportunity to learn by a) actively engaging them in the learning process, b) supplementing instruction through a variety of multimedia, c) allowing students to choose when and where they learn; d) allowing students to work at their own pace, and e) providing immediate and accurate feedback. Results demonstrated that using technology equally supported students' performance in both traditional classrooms as well as classrooms with computer-assisted supplementary instruction.

Several students enrolling in higher education are being exposed to technology. For example, productive software such as: word processing, spreadsheets, and databases into traditional courses. Developmental adult students who are enrolled in colleges must experience well-designed instruction in terms of both efficacy and relevance in computer-based courses (Knowlton & Simms, 2010). These researchers described a project in which an instructional design model was used to create computer-based instruction in developmental mathematics courses. The results showed that if the project would have been centered on the design, development of the institution of the instructors' course, instructional design, and students' experience of success in learning math, it would contribute to students' long-term success throughout their college experience.

Computer-based instruction has dated back to when computers were first used. Online education became popular in U.S. higher education to assist developmental students in succeeding in developmental mathematics courses. Several colleges are using different types of software to teach online developmental mathematics courses using online problems and tasks that are graded by computer. Potocka (2010) described an effective innovative teaching method and cost-efficient way of teaching online developmental mathematics courses where no instructor is needed to teach the course, and students are taught entirely by the computer while learning at their own pace. Potocka (2010) compared students' performance in a traditional in-class course to the completely computer-based one. Results showed that computer instruction cannot replace face-to-face instruction; however, offering developmental mathematics course online is beneficial for student success in developmental mathematics courses (Potocka, 2010).

Mastery Learning is a pedagogical strategy used to teach developmental college students. Several colleges are using e-learning computer programs as an instructional tool for developmental mathematics to deliver instruction to developmental students in a Mastery Learning format. The computer programs enhance the course instruction via computer and the internet. For successful Mastery Learning to take place in developmental mathematic courses, Boggs, Shore, and Shore (2004) discussed four things that must occur in e-learning: a) creating multiple versions of tests, b) grading multiple versions of tests for students at different stages of the course, c) planning different times for students to take different versions of the test, and d) teaching students who are placed on different learning objectives. The results showed that by using e-learning computer programs, students were successfully completing developmental mathematics courses. Instructors were also able to create multiple versions of tests and assigned different times for students to take them in order for students to succeed in developmental mathematics coursework (Boggs et al., 2004).

Students that graduate from high school and enroll in college are asked to become more responsible for their own learning skills such as flexible learning strategies and self-efficacy. A small amount of research has examined the effects of these factors on achievement in an online learning setting. Wadsworth, Husman, Duggan, and Pennington (2007) investigated learning strategies and self-efficacy, demonstrating that successful college students in an online developmental mathematics course provided evidence of the correlation between learning strategies, motivation, self-efficacy, and student achievement. The results provided insight into the importance of learning strategies used in an online developmental setting to ensure student success. Additionally, the success rates in online developmental courses increased (Wadsworth et al., 2007).

In order to counteract the negative impact of large mathematics class sizes in colleges, more student learning is taking place outside of classrooms. Therefore, instructors are adding online homework to mathematic courses and looking to technology such as MyMathLab, WebAssign, WebWork, and ALEKS to provide solutions without reducing the number of classroom hours. Gleason (2012) focused on how many students should be enrolled in each weekly class session and if the impact of the population of the class sessions differed with the content level of the course. The results showed that applying a solid technology component involving online homework, quizzes, and tests can help improve the impact of student achievement and satisfaction. Additionally, required resources such as the availability of tutoring and frequent interaction by email between the instructor and the students were also needed for students' success and motivation (Gleason, 2012).

Several colleges are rapidly offering more computer-based instruction and distance learning courses. In a qualitative study, Zavarella and Ignash (2009) examined the chance of students withdrawing from a computer-based format versus lecture-based format developmental math courses based on learning style, reasons for selecting the instructional format, and entry test scores. Computer-based instruction can be an important educational alternative for some students; however, the results show that the drop-out rate was higher for those students enrolled in a computer-based format compared to those students enrolled in a lecture-based format of developmental mathematics courses (Zavarella & Ignash, 2009).

In higher education, there is a wide range of technologies available to aid learning for students. Borman and Sleigh (2011) discussed approaches taken to increase engagement using interactive teaching components and included survey results from students using on-line resources contained in an Electronic Student Toolkit for Engagement in Engineering Mathematics under the development at the University of Leeds. The results showed that the combined interactive lecture components were seen by students as valuable and useful as an encouragement to learning. However, the study could not draw conclusions in terms of improvements to student learning (Borman & Sleigh, 2011).

Digital natives are students often defined as those born after 1980 and naturally fluent with a variety of digital technologies. Thompson (2013) investigated and explored digital native patterns of technology use and approaches to learning. The results showed that students may not be using the full benefits of technology tools when used in a learning context and suggested that the influence of technology on the digital natives' approach to learning is diverse and complex. Consequently, teachers can play an important role in preparing students for success by scaffolding and helping them navigate successfully in the digital world (Thompson, 2013).

In higher education, mathematics departments across the United States have been changing their remedial programs to increase their student success rate by introducing new models of teaching formats. For both financial and pedagogical reasons, Nevada State College chose to reconstruct their remedial program through a content modularization system. Wong (2013) examined the rationale for change, the first year's data, and the discussion of planned future developments to the remedial program. The results showed that the system can only be considered a success if it increased the level of student success moving through the remedial courses into college-level mathematics courses. Consequently, there are still many avenues to follow to strengthen the program further such as a) development of materials that can be used to supplement the modules, b) work with academic advising to create an integrated system to locate students that are weak and help them to successfully pass the modules, and c) review of both the curriculum and the placement of students (Wong, 2013).

Enrollment in community colleges and the number of online courses offered through these colleges are increasing faster than in four-year universities across the nation. Ashby, Sadera, and McNary (2011) compared student success in developmental mathematics courses in three diverse learning settings: a) online, b) blended, and c) face-to-face. The results showed that online and blended students performed lower than the traditional face-to-face developmental mathematics students. Consequently, future research is needed to further examine success rates of developmental mathematics students in online and blended learning environments (Ashby et al., 2011).

Across the nation, colleges are using technology-based pedagogy in their classrooms. Hashemzadeh and Wilson (2007) determined if students enrolled in economic courses benefited from widespread use of technology based pedagogy and learning tools. The results showed that technologically instructional innovations did not imply an increase in student engagement or achievement. Consequently, technology obstructed the learning process and limited spontaneous interaction between instructor and student, therefore, disengaging the student and negatively impacting student achievement (Hashemzadeh & Wilson, 2007).

Remediation programs in higher education begin with courses that teach basic grammar-school level skills to developmental students. Hammerman and Goldberg (2003) examined strategies such as a) reversing the negative student attitudes towards the remediation resources, b) presenting the resources in a significant way that is geared for understanding rather than for memorization, and c) incorporating students' experiences outside of the classroom in the examples presented during class and apply the approaches to developmental mathematic courses. The results showed that the strategies were successful at the beginning of the semester and throughout the semester. Consequently, additional ideas and the collection of more strategy techniques are needed for further research (Hammerman & Goldberg, 2003).

In community colleges, technology is being incorporated into developmental courses across the nation. By the implementation of technological pedagogy into developmental mathematic courses, Epper and Baker (2009) investigated how technology program designs can develop, strengthen, and be effective in the delivery of developmental mathematical practices. The results showed that technology designs have been identified as effective strategies for developmental students (Epper & Baker, 2009).

Math magic is another developmental teaching system for mathematics students. The components of this system are similar to *MyMathLab*. Implementing appropriate use of computers for developmental teaching in education has shown that this system improves the overall mathematics performance of students (Paravate et al., 1998).

In conclusion, several colleges are teaching developmental students by traditional lecture method. By moving away from the traditional lecture method, (Brothen, 1998; Keup, 1998) suggested how technology can improve education for developmental students and help developmental students become successful learners. The results showed that students learn to succeed with the application of technology through the multiplier effect. Consequently, the effects of technology can be beneficially multiplied as it is applied to a wide array of developmental courses (Brothen, 1998). Thus, the forthcoming section describes the methodology employed in this study.

3. METHODOLOGY

Introduction

This study was designed to assist mathematics educators in helping developmental students, in particular Hispanic pupils, succeed in developmental mathematics in higher education. There has been much research published on developmental education in helping students succeed in higher education within minorities, yet there has been minimal research done on Hispanic students enrolled in a border town community college. The purpose of this study was to explore whether a web-based technology, *MyMathLab*, makes a difference in students' success in both a developmental mathematics course and a subsequent College Algebra course. Additionally, this study examined whether the effect differs by instructors' characteristics contributing to successes or failures of students in developmental mathematic courses.

Research Questions

There were four questions that framed this study. Each question addressed the success rate for students taking Math0375, Math0376, and Math1314 measured by grade distribution and *MyMathLab* for certain years. The instructors' characteristics which were determined by two surveys were important and may have contributed to student successes or failures in these developmental and college algebra classes.

Research Questions:

1A) What was the success rate for students who take Math0376 before *MyMathLab*

(2001-2005) as measured by grade distribution?

1B) What was the success rate for students who take Math0376 with *MyMathLab* (2008-2012) as measured by grade distribution and pre and post *MyMathLab* tests?

2A) What was the success rate for students who take Math0376 before *MyMathLab* and who earned an A, B, or C in Math0375?

2B) What was the success rate for students who take Math0376 with *MyMathLab* and who earned an A, B, or C in Math0375?

3) Does the traditional developmental math course or the course enhanced with *MyMathLab* have a higher success rate for students who enroll in college algebra (Math1314) (range of what can be earned A, B, C, D, F, or W)?

4) What instructor characteristics as determined through two surveys may contribute to student successes or failures in these developmental and college algebra classes?

Participants and Setting

This study occurred at a predominately Hispanic South Texas community college. The following Tables 1-10 show the students' Fall demographic information for the community college by gender, age, ethnicity and disadvantage classification. Table 11 depicts all students taking developmental courses at the community college. Table 12 depicts the demographics for the particular participants examined in this study and were obtained from the research and planning office of the community college. A random sampling was used for this research to collect extant data. The study participants (N = 200) were primarily Hispanic students ranging in age from 20 to 65 who were formally enrolled in developmental-level mathematics classes (Math0375 and Math0376) and a College Algebra class (Math1314) from 2001 to 2012. The instructors' (N=18) participating in the study had at least a master's degree with at least 18 graduate hours in mathematics and met the minimum requirements set forth by the Texas Coordinating Board for teaching college-level courses at a community college. The instructors were asked to sign a consent form (see Appendix C).

Table 1
2001 Demographics for the Community College

	Male	Female	Total	
Enrollment	*n*	*n*	*n*	%
Full-Time	1,241	1,758	2,999	40.02%
Part-Time	1,853	2,641	4,494	59.98%
Total	3,094	4,399	7,493	100.00%
Under 18	63	110	173	2.31%
18-20	1,168	1,513	2,681	35.78%
21-25	1,053	1,281	2,334	31.15%
26-30	361	559	920	12.28%
31-40	267	596	863	11.52%
Over 40	182	340	522	6.97%
Hispanic	2,878	4,113	6,991	93.30%
International	119	175	294	3.92%
White, Non-Hispanic	63	81	144	1.92%
Asian or Pacific /Islander	9	13	22	0.29%
Black, Non-Hispanic	6	5	11	0.15%
Native American	4	5	9	0.12%
Unknown or Not Reported	15	7	22	0.29%
Academically Disadvantaged	1,527	2,184	3,711	49.53%
Economically Disadvantaged	1,456	2,503	3,959	52.84%
Disabled	65	60	125	1.67%
Limited-English Proficient	1,471	2,111	3,582	47.80%
Displaced Homemaker	8	53	61	0.81%
Single Parent	3	66	69	0.92%

Table 2

2002 Demographics for the Community College

	Male	Female	Total	
Enrollment	*n*	*n*	*n*	%
Full-Time	1,323	1,750	3,073	39.57%
Part-Time	1,888	2,805	4,693	60.43%
Total	3,211	4,555	7,766	100.0%
Under 18	51	120	171	2.20%
18-20	1,183	1,568	2,751	35.42%
21-25	1,117	1,346	2,463	31.72%
26-30	389	543	932	12.00%
31-40	289	599	888	11.43%
Over 40	182	379	561	7.22%
Hispanic	3,010	4,310	7,320	94.26%
International	118	147	265	3.41%
White, Non-Hispanic	68	78	146	1.88%
Asian or Pacific /Islander	11	11	22	0.28%
Black, Non-Hispanic	3	7	10	0.13%
Native American	1	1	2	0.03%
Unknown or Not Reported	0	1	1	0.01%
Academically Disadvantage	1,843	2,624	4,467	57.52%
Economically Disadvantaged	1,726	2,807	4,533	58.37%
Disabled	60	53	113	1.46%
Limited-English Proficient	1,773	2,527	4,300	55.37%
Displaced Homemaker	8	61	69	0.89%
Single Parent	3	78	81	1.04%

Table 3
2003 Demographics for the Community College

	Male	Female	Total	
Enrollment	*n*	*n*	*n*	%
Full-Time	1,300	1,729	3,029	36.51%
Part-Time	2,083	3,185	5,268	63.49%
Total	3,383	4,914	8,297	100.00%
Under 18	80	137	217	2.62%
18-20	1,283	1,716	2,979	35.90%
21-25	1,148	1,498	2,646	31.89%
26-30	381	557	938	11.31%
31-40	328	601	929	11.20%
Over 40	183	405	588	7.09%
Hispanic	3,176	4,667	7,843	94.5%
International	116	140	256	3.1%
White, Non-Hispanic	62	80	142	1.7%
Asian or Pacific /Islander	14	10	24	0.3%
Black, Non-Hispanic	10	6	16	0.2%
Native American	1	2	3	0.0%
Unknown or Not Reported	4	9	13	0.2%
Academically Disadvantage	1,948	2,916	4,864	58.6%
Economically Disadvantaged	1,357	2,420	3,777	45.5%
Disabled	63	45	108	1.3%
Limited-English Proficient	1,876	2,831	4,707	56.7%
Displaced Homemaker	5	43	48	0.6%
Single Parent	3	54	57	0.7%

Table 4
2004 Demographics for the Community College

	Male	Female	Total	
Enrollment	*n*	*n*	*n*	%
Full-Time	1,344	1,674	3,018	33.41%
Part-Time	2,359	3,655	6,014	66.59%
Total	3,703	5,329	9,032	100.00%
Under 18	107	193	300	3.32%
18-20	1,456	1,824	3,280	36.32%
21-25	1,231	1,589	2,820	31.22%
26-30	371	619	990	10.96%
31-40	330	703	1,033	11.44%
Over 40	208	401	609	6.74%
Hispanic	3,470	5,054	8,524	94.4%
International	134	165	299	3.3%
White, Non-Hispanic	73	84	157	1.7%
Asian or Pacific /Islander	11	8	19	0.2%
Black, Non-Hispanic	9	6	15	0.2%
Native American	1	2	3	0.0%
Unknown or Not Reported	5	10	15	0.2%
Academically Disadvantage	2,228	3,135	5,363	59.4%
Economically Disadvantaged	2,098	3,428	5,526	61.2%
Disabled	39	33	72	0.8%
Limited-English Proficient	2,144	3,151	5,295	58.6%
Displaced Homemaker	3	39	42	0.5%
Single Parent	3	44	47	0.5%

Table 5
2005 Demographics for the Community College

	Male	Female	Total	
Enrollment	*n*	*n*	*n*	%
Full-Time	1,419	1,781	3,200	38.56%
Part-Time	2,085	3,013	5,098	61.44%
Total	3,504	4,794	8,298	100.00%
Under 18	67	93	160	1.93%
18-20	1,465	1,699	3,164	38.13%
21-25	1,123	1,449	2,572	31.00%
26-30	332	560	892	10.75%
31-40	311	603	914	11.01%
Over 40	206	390	596	7.18%
Hispanic	3,295	4,512	7,807	94.1%
International	132	186	318	3.8%
White, Non-Hispanic	60	71	131	1.6%
Asian or Pacific /Islander	10	15	25	0.3%
Black, Non-Hispanic	7	7	14	0.2%
Native American	0	2	2	0.0%
Unknown or Not Reported	0	1	1	0.0%
Academically Disadvantage	2,276	3,134	5,410	65.2%
Economically Disadvantaged	1,459	2,465	3,924	47.3%
Disabled	28	24	52	0.6%
Limited-English Proficient	2,201	3,057	5,258	63.4%
Displaced Homemaker	0	24	24	0.3%
Single Parent	1	24	25	0.3%

Table 6
2008 Demographics for the Community College

	Male	Female	Total	
Enrollment	*n*	*n*	*n*	%
Full-Time	1,351	1,647	2,988	36.31%
Part-Time	2,151	3,107	5,258	63.69%
Total	3,502	4,754	8,256	100.00%
Under 18	127	225	352	4.26%
18-20	1,556	1,715	3,271	39.62%
21-25	1,062	1,363	2,425	29.37%
26-30	319	565	884	10.71%
31-40	259	548	807	9.77%
Over 40	179	338	517	6.26%
Hispanic	3,307	4,550	7,8576	95.2%
International	109	114	223	2.7%
White, Non-Hispanic	58	53	111	1.3%
Asian or Pacific /Islander	11	17	28	0.3%
Black, Non-Hispanic	8	7	15	0.2%
Native American	4	3	7	0.1%
Unknown or Not Reported	5	10	15	0.2%
Academically Disadvantage	1,642	1,878	3,520	42.6%
Economically Disadvantaged	1,478	2,284	3,762	45.6%
Disabled	94	72	166	2.0%
Limited-English Proficient	1,500	2,217	3,717	45.0%
Displaced Homemaker	1	29	30	0.4%
Single Parent	0	17	17	0.2%

Table 7
2009 Demographics for the Community College

	Male	Female	Total	
Enrollment	*n*	*n*	*n*	%
Full-Time	1,498	1,888	3,365	36.55%
Part-Time	2,422	3,456	5,878	63.45%
Total	3,920	5,344	9,264	100.00%
Under 18	220	355	575	6.21%
18-20	1,717	1,956	3,673	39.65%
21-25	1,146	1,449	2,595	28.01%
26-30	377	587	964	10.41%
31-40	280	641	921	9.94%
Over 40	180	356	536	5.79%
Hispanic	3,727	5,149	8,876	95.81%
International	74	83	157	1.69%
White, Non-Hispanic	78	66	144	1.55%
Asian or Pacific /Islander	15	19	34	0.37%
Black, Non-Hispanic	9	8	17	0.18%
Native American	3	1	4	0.04%
Unknown or Not Reported	14	18	32	0.35%
Academically Disadvantage	1,757	1,976	3,733	40.30%
Economically Disadvantaged	1,800	2,755	4,555	49.17%
Disabled	115	90	205	2.21%
Limited-English Proficient	1,170	1,156	2,326	25.11%
Displaced Homemaker	1	20	21	0.23%
Single Parent	0	24	24	0.26%

Table 8
2010 Demographics for the Community College

	Male	Female	Total	
Enrollment	*n*	*n*	*n*	%
Full-Time	1,685	2,704	3,759	37.48%
Part-Time	2,633	3,637	6,270	62.52%
Total	4,318	5,711	10,029	100.00%
Under 18	195	366	561	5.59%
18-20	1,883	2,250	4,133	41.21%
21-25	1,350	1,483	2,833	28.25%
26-30	412	652	1,064	10.61%
31-40	296	628	924	9.21%
Over 40	182	332	514	5.13%
Hispanic	4,085	5,490	9,575	95.47%
International	51	48	99	0.99%
White, Non-Hispanic	93	74	167	1.67%
Asian or Pacific /Islander	12	20	32	0.32%
Black, Non-Hispanic	15	13	28	0.28%
Native American	4	2	6	0.06%
Unknown or Not Reported	58	62	120	1.20%
Academically Disadvantage	1,900	2,234	4,134	41.22%
Economically Disadvantaged	2,214	3,149	5,363	53.47%
Disabled	136	92	228	2.27%
Limited-English Proficient	1,140	1,182	2,322	23.15%
Displaced Homemaker	2	10	12	0.12%
Single Parent	1	19	20	0.20%

Table 9
2011 Demographics for the Community College

	Male	Female	Total	
Enrollment	*n*	*n*	*n*	%
Full-Time	1,666	1,890	3,556	35.29%
Part-Time	2,766	3,754	6,520	64.71%
Total	4,432	5,644	10,076	100.00%
Under 18	244	331	575	5.71%
18-20	2,009	2,412	4,421	43.88%
21-25	1,337	1,500	2,837	28.16%
26-30	372	555	927	9.20%
31-40	298	526	824	8.18%
Over 40	172	320	492	4.88%
Hispanic	4,232	5,419	9,651	95%
International	53	62	115	1.14%
White, Non-Hispanic	86	79	165	1.64%
Asian or Pacific /Islander	12	18	30	0.30%
Black, Non-Hispanic	5	9	14	0.14%
Native American	2	0	2	.02%
Unknown or Not Reported	42	53	95	0.94%
Academically Disadvantage	1,941	2,141	4,082	40.51%
Economically Disadvantaged	2,669	3,589	6,258	62.11%
Disabled	137	90	227	2.25%
Limited-English Proficient	1,286	1,198	2,484	24.65%
Displaced Homemaker	0	0	0	0.00%
Single Parent	0	0	0	0.00%

Table 10

2012 Demographics for the Community College

	Male	Female	Total	
Enrollment	*n*	*n*	*n*	%
Full-Time	1,617	1,789	3,406	36.40%
Part-Time	2,508	3,422	5,950	63.60%
Total	4,125	5,231	9,356	100.00%
Under 18	240	364	604	6.46%
18-20	1,943	2,236	4,179	44.67%
21-25	1,222	1,404	2,626	28.07%
26-30	317	511	828	8.85%
31-40	270	456	726	7.76%
Over 40	133	260	393	4.20%
Hispanic	3,952	5,044	8,996	96.15%
International	54	62	116	1.24%
White, Non-Hispanic	61	62	123	1.31%
Asian or Pacific /Islander	19	12	31	0.33%
Black, Non-Hispanic	6	13	19	0.20%
Native American	5	1	6	0.06%
Unknown or Not Reported	24	34	58	0.62%
Academically Disadvantage	1,578	1,700	3,278	35.04%
Economically Disadvantaged	2,388	3,305	5,693	60.85%
Disabled	174	130	304	3.25%
Limited-English Proficient	1,071	962	2,033	21.73%
Displaced Homemaker	0	0	0	0.00%
Single Parent	0	0	0	0.00%

Table 11
Developmental students Demographics

Years	Total number of students *n*	Total number of developmental students *n*	Total percent of developmental students %
Fall 2001	7,470	2,413	32.3%
Fall 2002	7,748	2,386	30.8%
Fall 2003	7,906	2,279	28.8%
Fall 2004	8,328	2,475	29.7%
Fall 2005	8,169	2,202	27.0%
Fall 2008	8,256	2,280	27.6%
Fall 2009	9,264	2,311	24.9%
Fall 2010	10,029	2,691	26.8%
Fall 2011	10,076	2,906	28.8%
Fall 2012	9,356	2,316	21.7%

Table 12
Study Participant Demographics

Year	*n*=200	Male	Female	Age	Hispanic
2001-2002	20	6	14	31-54	20
2002-2003	20	6	14	31-51	20
2003-2004	20	6	14	28-62	20
2004-2005	20	6	14	27-58	20
2005-2006	20	9	11	27-50	20
2008-2009	20	14	6	23-55	20
2009-2010	20	8	12	24-44	20
2010-2011	20	9	11	23-29	20
2011-2012	20	9	11	20-54	20
2012-2013	20	9	11	21-44	20

Instrumentation

CourseCompass also referred to as *MyMathLab* is developed and marketed through Pearson Education. The web-based program that was used to collect the pre and post-test was entitled, *MyMathLab*. The customized pre and post-test administered in this study consisted of eleven problems used in the course Math0376 from the year 2008 to present. All questions come from the objectives of the Math0376 required textbook. Objectives include: solve absolute value equations, solve absolute value inequalities of the form absolute value of x less than a, graph linear inequality in two variables, find nth roots, simplify radicals, solve equations that contain radical expressions, written square roots of negative numbers in the form bi, solve quadratic equations by completing the square, solve quadratic equations by using the quadratic formula, graph quadratic functions of the form f(x)=a(x-h)^2+k, and graph a quadratic function and find the vertex, intercepts, and direction of opening.

The first survey was used to measure the teachers mathematics teaching belief efficacy was adapted from the authors *Mathematics Teaching Belief Efficacy Instrument* (MTEBI) developed by Larry G. Enochs and Iris M. Riggs. The *MTEBI* consists of 21 items, 13 items on the *Personal Mathematics Teaching Efficacy* (PMTE) subscale and 8 items on the *Mathematics Teaching Outcome Expectancy* (MTOE) subscale. Published reliability analysis produced an α= 0.88 for the *PMTE* scale and an α= 0.75, adding to the construct validity of the *MTEBI* (Enochs, Smith, & Huinker, 2000). The *METBI* was modified to use language fit for a college setting see Appendix A. The questions that were modified from the original *MTEBI* were: 3, 5, 6, 8, 10, 11, 14, 15, 16, 17, 18, 19, and 20. Question 14 and Question 18 was removed. The modifications include: Question 3 the word "will" was replaced with the word "do". Question 5 the sentence "how" was replaced with the word "the steps necessary". Question 6 the word "am" was replaced with the word "will". Question 8, 15, 17, and 20 the word "will" was removed. Question 10 the word "child" was replaced with the word "student". Question 11 the word "elementary" was removed. Question 16 and 19 the word "am" was replaced with the word "will". Question 15, 16, 17, 19, and 20 the word "will" was removed as seen in Table 13. The *MTEBI* was used to measure teachers' mathematical teaching beliefs and efficacy.

Table 13
MTEBI Modified Questions

Modified of *MTEBI* 19 Questions	Added text to questions	Original *MTEBI* 21 Questions	Removed text from questions/ removed two questions
1		1	
2		2	
3	do	3	will
4		4	
5	the steps necessary	5	how
6	will	6	am
7		7	
8		8	will
9		9	
10	students	10	child
11		11	elementary
12		12	
13		13	
		14	Removed question
14		15	will
15	am	16	will
16		17	will
		18	Removed question
17	am	19	will
18		20	will
19		21	

The second survey, the *Instructors' Educational Philosophies* (IEP) instrument, was used to determine the instructors' personal philosophy of education. This instrument was adapted by the author from the instrument *Philosophies Held by Instructors of Lifelong-learners* (PHIL) (Conti, 2007). (*PHIL)* was developed to identify a respondent's preference for one of the major schools of philosophical thought: Idealism, Realism, Pragmatism, Existentialism, or Reconstructionism (Conti, 2007). The *Philosophy of Adult Education Inventory* (PAEI) has been determined to be a reliable and valid instrument for measuring adult education philosophies with reported Cronbach's α=.75 (Boone et al., 2002). The pool of items for developing *PHIL* was the 75 items of *PAEI* (Conti, 2007). The adapted *IEP* instrument used in this study consisted of 25 questions. Questions 1-25 focused on teacher-centered and learner-centered. The philosophies that fall under teacher centered approach to learning are: Idealism and Realism. The philosophies that fall under learner-centered approach to learning are: Pragmatism, Existentialism, and Reconstructionism. Knowledge of your educational philosophy can help educators in many ways in their professional practice, therefore; research shows that when instructors are consistent in their teaching style, students are able to learn more effectively and succeed (Conti, 2007). The (*IEP)* was modified to use language fit for a college setting see Appendix B. The questions that were modified from the (*PHIL)* were: 1, 3, 4, 5, 6, 7, 8, 9, 12, 14, 15, 17, 18, 19, and 25. The modifications include: Question 1, 3, 4, 5, 12, 14, 15, and 17 the word "educational activity" was replaced with the word "mathematics lesson". Question 6 the word "adult" was replaced with the word "mathematics". Question 7 the word "adults" was replaced with the word "mathematics". Question 8 and 9 the word "mathematical" was added. Question 18 the word "mathematics" was added. ". Question 19 the sentence "developmental mathematics" was replaced with the word "an adult". Question 25 the word "an educational activity" was replaced with the word "a mathematical lesson" as seen in Table 14.

Table 14
IEP Modified Questions

Modified of *IEP* 25 Questions	Added text to questions	Original *PHIL* 25 Questions	Removed text from questions
1	a mathematics lesson	1	an educational activity
2		2	
3	a mathematics lesson	3	an educational activity
4	a mathematics lesson	4	an educational activity
5	a mathematics lesson	5	an educational activity
6	mathematics	6	adult
7	mathematics	7	adults
8	mathematical	8	
9	mathematical	9	
10		10	
11		11	
12	a mathematics lesson	12	an educational activity
13		13	
14	a mathematics lesson	14	an educational activity
15	a mathematics lesson	15	an educational activity
16		16	
17	a mathematics lesson	17	an educational activity
18	mathematics	18	
19	a developmental mathematics	19	an adult
20		20	
21		21	
22		22	
23		23	
24		24	
25	a mathematical lesson	25	an educational activity

Data Collection

Data collected for each participant were grades in Math0375, Math0376, and Math1314. Pre-test and post-test scores on *MyMathLab* were collected for the course Math0376, and two surveys administered to the community college instructors. Students' grades were collected from the research and planning department at the college for ten different years (2001-02, 02-03, 03-04, 04-05, 05-06 & 08-09, 09-10, 10-11, 11-12 and 12-13). These data were used for this study to cross sample students who: a) were enrolled in *MyMathLab* (after 2005) and b) those prior to the adoption of *MyMathLab* (before 2005). To allow for transition and to ensure the intervention was in place, the years of 2006-07 were omitted from the study. Additionally, *MyMathLab* Pre and Posttest was collected randomly from each instructor for the course Math0376 for each year from 2008 to 2012.

Data collected from the community college instructors took the form of two surveys. The two surveys *MTEBI* and *IEP* and a SCANTRON were placed in a legal envelope and sealed. Then, the instructors were asked to sign a consent form before they were given the envelope. . For the *MTEBI* survey, the instructors were asked to bubble on the SCANTRON either A=Strongly Agree, B=Agree, C=Uncertain, D=Disagree, and E=Strongly Disagree. In the analysis of the data, the scales were transformed for this study: A was reported as the number 1, B as 2, C as 3, D as 4, and E as 5. For the *IEP* survey, the instructors were asked to bubble in the SCANTRON either A=Agree or B=Disagree. The instructors were then given a week to complete the two surveys and return them to a specific location in the same sealed envelope.

Data Analyses

Data for each student included grade distributions and *MyMathLab* pre-test and post-test for certain years. For the instructors, data were gathered from the two surveys. The grade distribution from 2001-2002, 2002-2003, 2003-2004, 2004-2005, and 2005-2006 before using *MyMathLab* and the grade distributions from 2008-2009, 2009-2010, 2010-2011, 2011-2012, 2012-2013 using *MyMathLab* and the two surveys were analyzed using SPSS. Differences between selected groups were analyzed through the use of descriptive statistics such as error bar graphs, bar charts, box plots, stem and leafs and other relevant visual aids.

To answer the 6 research questions, quantitative research methods and display techniques were employed. Differences between Math0375, Math0376, and Math1314 were analyzed through the use of descriptive statistics to examine the mean scores for each course. Also, differences between Math0375, Math0376, and Math1314 were analyzed through the use of descriptive statistics examining the frequencies for each grade distribution. Data from questions 1A and 1B were analyzed with error bars using the 95% confidence interval to compare Math0376 grade distribution and years. Additionally, questions 1A and 1B were analyzed with error bars using 95% confidence intervals to compare Math0376 grade distribution and gender. Also for questions 1A and 1B, a bar chart was used to compare Math0376 grade distribution and 100 students from the years 2001-2005. For Question 1B, the standard deviation and variance are each based on all of the students' scores of *MyMathLab* pre-test. However, *MyMathLab* pre-test was not used for the study due to all students scoring a zero. Furthermore, the students' would be at zero when calculating the standard deviation and calculating the variance by squaring the standard deviation. Thus, there would be no standard deviation for the students *MyMathLab* pre-test. A regression was conducted to compare the effect of students Math0376 student's grades on *MyMathLab* post-test. Effect sizes for the regression analysis were computed using *R squared* (R^2). Furthermore, a Pearson correlation coefficient was computed to assess the relationship between Math0376 students' grades and *MyMathLab* post-test.

For question 2A, differences between Math0375 and Math0376 were analyzed through the use of descriptive statistics to examine the mean scores for each course before using *MyMathLab*. For question 2B, differences between Math0375 and Math0376 were analyzed through the use of descriptive statistics to examine the mean scores for each course using *MyMathLab*. For questions 2A and 2B error bars using 95% confidence intervals were employed to compare Math0376 grade distribution and with using *MyMathLab*. Furthermore, for questions 2A and 2B error bars with 95% confidence intervals were employed to compare Math0376 grade distribution and gender before using *MyMathLab.* Additionally, for questions 2A and 2B error bars using 95% confidence intervals were used to compare Math0376 grade distribution and gender with using *MyMathLab*. Confidence intervals are a range of values. If your sample and variable is small, the sample mean is most likely to be quite far from the population mean. If your sample is large and has little scatter, the sample mean will most probably be very close to the population mean. Statistical calculations combine sample size and variability (standard deviation) to generate a confidence interval for the population mean.

For Question 2A, a one-way between subjects Analysis of Variance (ANOVA) was conducted to compare the effect of students Math0375 grades (A, B, C) on the students' performance in Math0376 before using *MyMathLab*. Effect sizes for the regression analysis were computed using adjusted *R squared* (R^2). For Question 2B, a one-way between subjects Analysis of Variance (ANOVA) was conducted to compare the effect of students Math0375 grades (A, B, C) on the students' performance in Math0376 while using *MyMathLab*. Effect sizes for regression analysis were computed using *R squared* (R^2).

For question 3, differences between Math0375, Math0376, and Math1314 were analyzed through the use of descriptive statistics to examine the mean scores for each course before using *MyMathLab* and with using *MyMathLab*. Data from question 3 error bars with 95% confidence intervals were used to compare Math1314 grade distribution and years. Also, Math1314 was analyzed through the use of a stem-and-leaf plot to examine the frequencies for each grade distribution before using *MyMathLab* and with using *MyMathLab*. Additionally, Math1314 was analyzed through the use of a box-whisker plots to examine grade distribution before using *MyMathLab* and with using *MyMathLab*. A one-way between subjects Analysis of Variance (ANOVA) was conducted to compare the effect of students Math0375 grades (A, B, C) and Math0376 grades (A, B, C) on the students' performance in Math1314 grades (A, B, C, D, F, or W) while using *MyMathLab*. Effect sizes for regression analysis were computed using *R* *squared* (R^2). Furthermore, a Pearson correlation coefficient was computed to assess the relationship between the grade distributions of Math1314, Math0375, and Math0376 for each course before using *MyMathLab* and with using *MyMathLab*.

For question 4 using the first survey *MTEBI*, differences between instructor's responses to the survey were analyzed through the use of descriptive statistics to examine the mean scores for each question. Also, differences between instructor's responses to perceptions *of personal teaching efficacy* (PTE) and *teaching outcome expectancy* (TOE) were analyzed through the use of descriptive statistics to examine the mean scores for both efficacy and outcome. For the *IEP* survey, a paired-samples *t*-test was employed in this study to compare the sample means of the learner-centered approach and teacher-centered approach to determine if there were a statistically significantly difference.

Summary

The research questions used in this study were stated to determine if a web-based technology, *MyMathLab*, makes a difference in students' success in both a developmental mathematics course and a subsequent College Algebra course. Additionally, this study examined whether the effect differed by instructors' characteristics contributing to successes or failures of students in developmental mathematics courses. The participants were described along with the setting of the study, the data collection and data analysis. Chapter 4 will discuss the results of the analysis described in Chapter 3.

4. RESULTS

Introduction

The major focus of this section is to present the results related to student success in developmental mathematics courses as measured by pre and post *MyMathLab* tests in addition to grade distributions from 2001 and 2005 (before *MyMathLab*) across the two developmental courses and a college algebra course and the implementation of *MyMathLab* between 2008-2012 to determine if using *MyMathLab* had an impact on student success in two developmental courses and an early algebra course. In order to help organize this section, the research questions 1A) and 1B) and 2A) and 2B) will be discussed together and are outlined here:

1A) What was the success rate for students who took Math0376 before *MyMathLab* (2001-2005) as measured by grade distribution?

1B) What was the success rate for students who took Math0376 with *MyMathLab* (2008-2012) as measured by grade distribution and pre and post *MyMathLab* tests?

2A) What was the success rate for students who took Math0376 before *MyMathLab* and who earned an A, B, or C in Math0375?

2B) What was the success rate for students who took Math0376 with *MyMathLab* and who earned an A, B, or C in Math0375?

3) Does the traditional developmental math course or the course enhanced with *MyMathLab* have a higher success rate for students who enroll in college algebra (Math1314) (range of what can be earned A, B, C, D, F, or W)?

4) What instructor characteristics as determined through two surveys may contribute to student successes or failures in these developmental and college algebra classes?

In the analysis of the data, the grades were transformed for this study: A was coded as the number 5, B as 4, C as 3, D as 2, and F as 1, and W (Withdraw) as 0. The college institutional grading scale is A (4.0), B (3.9-3.0), C (2.9-2.0), D (1.9-1.0), and F (1.0 or less) as displayed in Table 15.

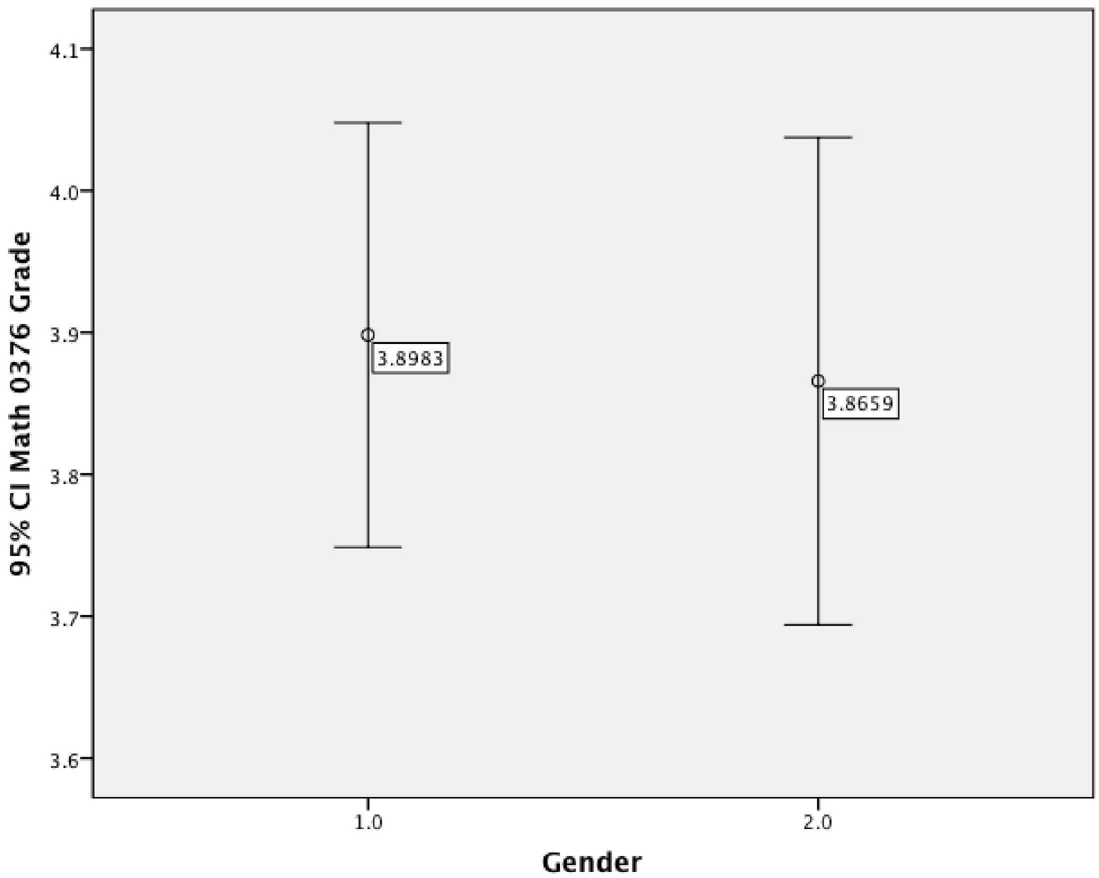
Table 15
Grade Scale Comparison

	Study	*Institution*
A	5.0	4.0
B	4.9-4.0	3.9-3.0
C	3.9-3.0	2.9-2.0
D	2.9-2.0	1.9-1.0
F	1.9-1.0	<1.0
W	0	

Note: In the study, 1 represented the students who completed the course but did not earn credit for the course and 0 represented the students who did not complete the course and did not earn credit for the course.

For the years combined, 2001-2005, before MyMathLab and 2008-2012 with MyMathLab, the Math0375 grade distribution ranged from 3.0 to 5.0 (M=3.71, SD=.77). The Math0376 grade distribution ranged from 3.0 to 5.0 (M=3.9, SD=.80). The Math1314 grade distribution ranged from 0 to 5.0 (M=2.29, SD=1.63). In Math0375 and Math0376, the number of students who earned an A was 38 and 54 respectively; students who earned a B were 67 and 69 respectively; those who earned a C were 95 and 97 respectively. Also, for the years combined 2001-2005 before *MyMathLab* and 2008-2012 with *MyMathLab*, in Math1314, 15 students earned an A, 44 earned a B, 38 earned a C, 31 earned a D, 30 students earned an F, and 42 students earned a W.

For the years combined 2001-2005 before *MyMathLab* and 2008-2012 with *MyMathLab*, both female and male students earned a mean grade of a high C (3.89) and C (3.86) as displayed by the error bars in Figure 3, which there was no statistically significance difference between males and females grades in Math0376.



Note. 1.0 = Female students. 2.0 = Male students.

Figure 3. 2001-2005 and 2008-2012 Math0376 grade distribution by gender.

Question 1A and 1B Students' Performance before MyMathLab and with MyMathLab

The analysis of the data for question 1A and 1B included an examination of the comparison of the success rate for students who enrolled in Math0376 before using *MyMathLab* (2001-2005) and for students who enrolled in Math0376 with using *MyMathLab* (2008-2012) as measured by grade distribution data. A comparison of initial visual conformation of grade distribution for Math0376 is presented in Figure 4 and Figure 5 displaying a bar chart of Math 0376 grade distributions before using

MyMathLab and with using *MyMathLab*. The bar chart in Figure 4 displays 54 students earning a grade of a C, 29 students earning a grade of a B, and 17 students earning a grade of A before using *MyMathLab*.

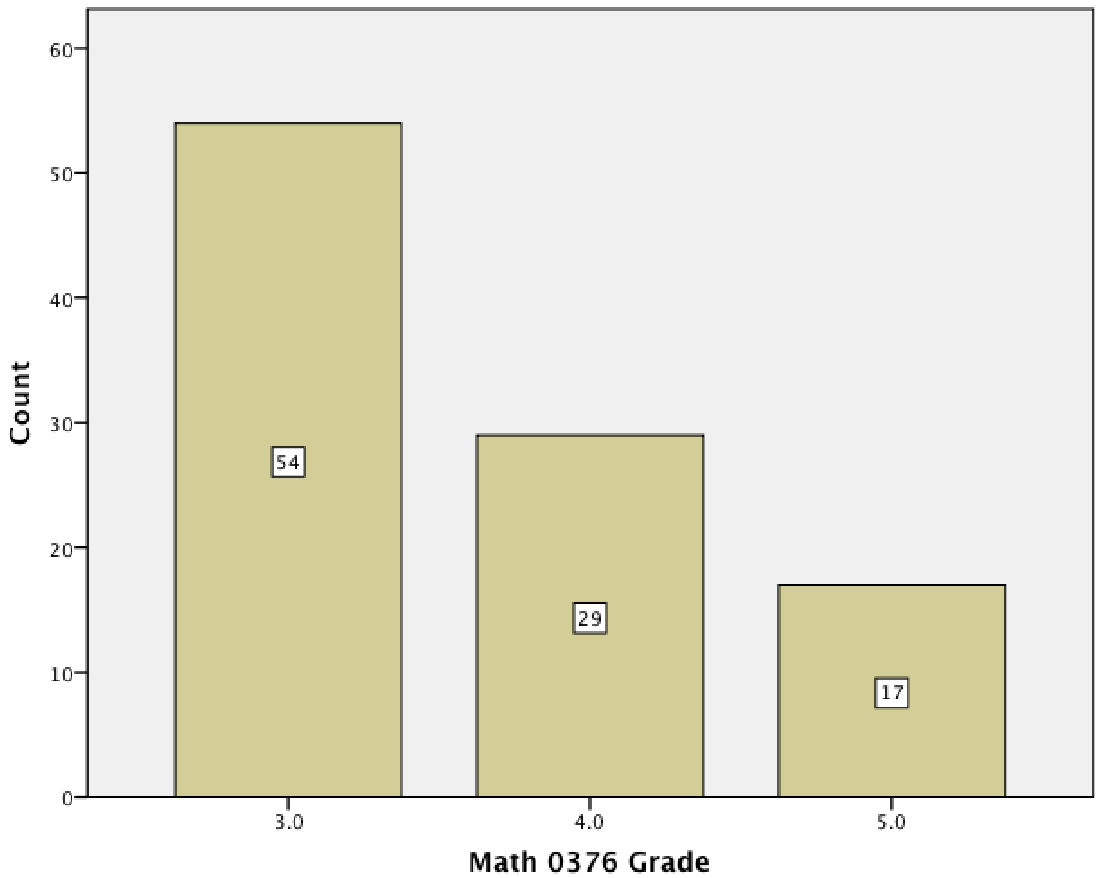


Figure 4. Bar chart grade distribution for Math0376 before MyMathLab.

Compared to the bar chart in Figure 5 of Math0376 grade distribution with using *MyMathLab* displays 23 students earning a grade of C, 40 students earning a grade of B, and 37 students earning a grade of A. Overall results show that students earned more A's (20) when using *MyMathLab* as compared to students before using *MyMathLab*.

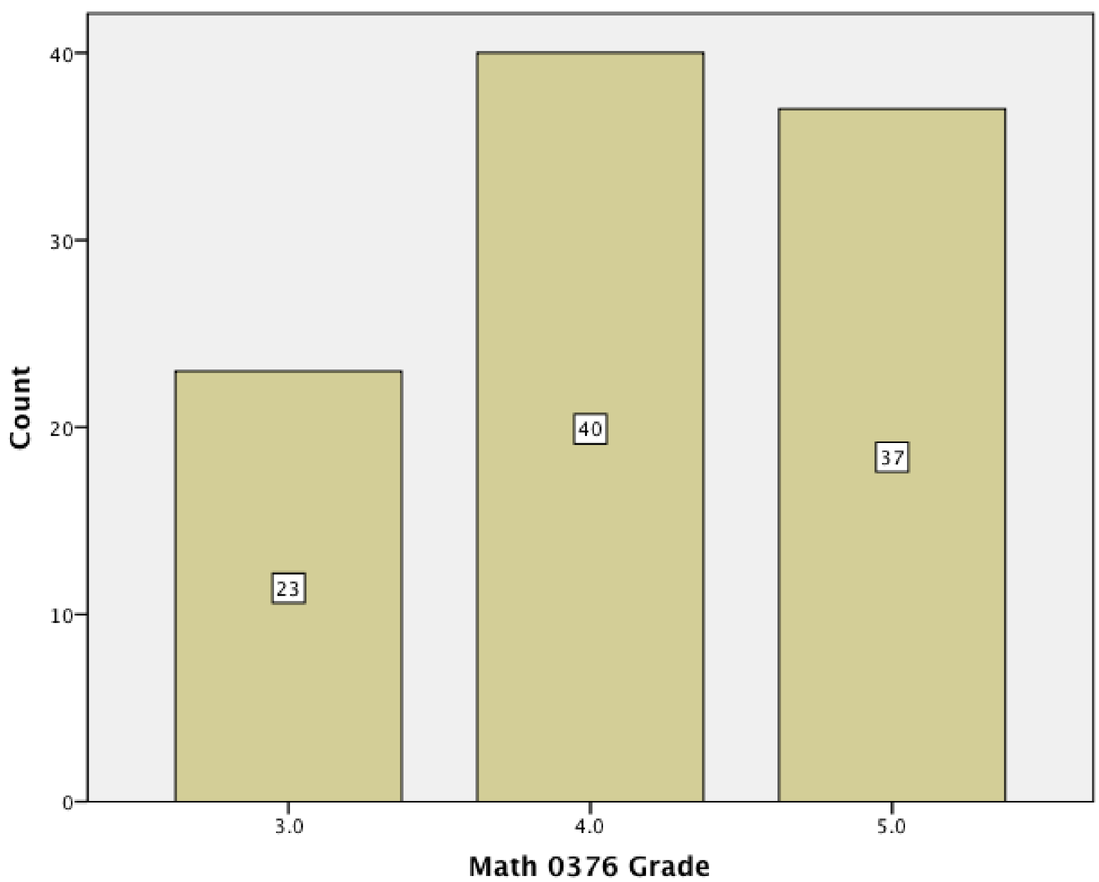


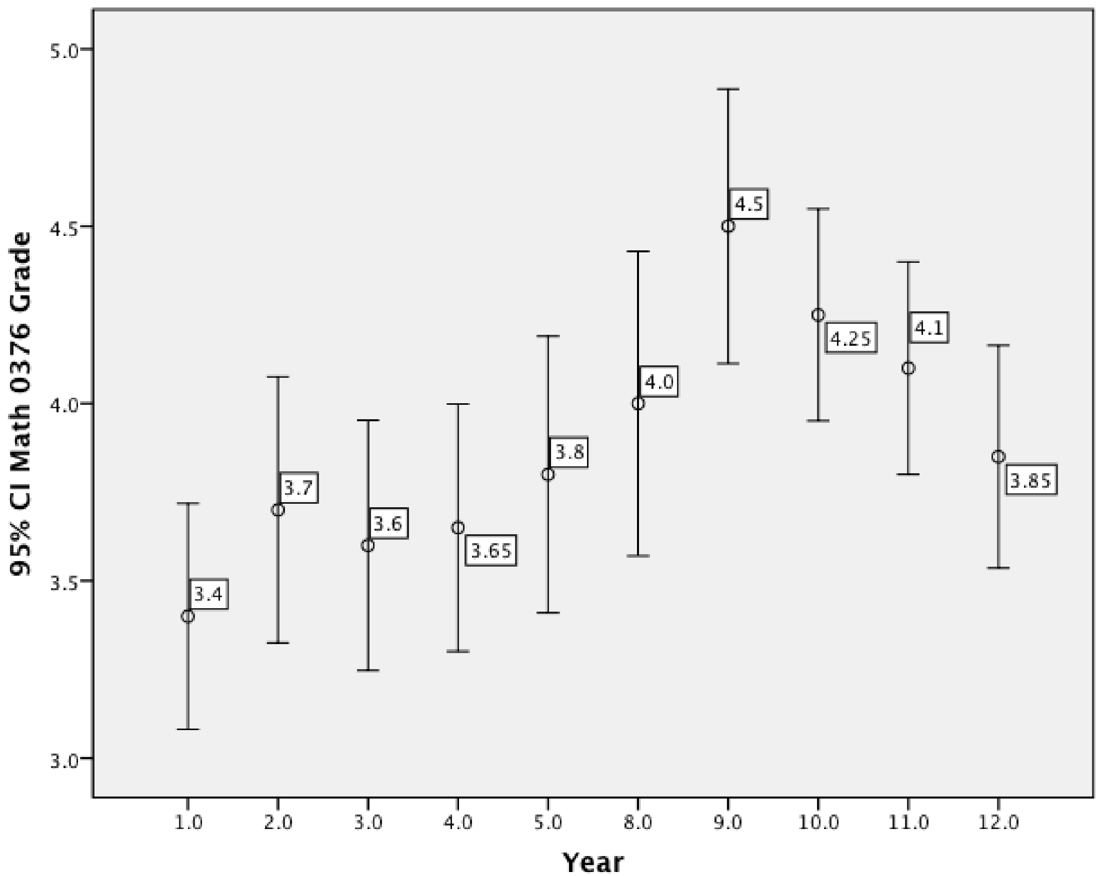
Figure 5. Bar chart grade distribution for Math0376 with MyMathLab.

Developmental students were not using *MyMathLab* between the years 2001-2005. Students earned a mean grade of a C (3.4) in Math0376 during the year 2001. Then, the students' grades progressed to a high C (3.7) during the year 2002 followed by a slight decline in 2003 where the mean grade was a C (3.6). During the 2004 school year, students' grades did not change from the previous year. During this year students were still earning a mean grade of a C (3.65). Beginning in 2005, students' grades reached the highest level as compared to the previous years of 2001-2004. In this year, students earned a mean grade of a high C (3.8).

Developmental students began using *MyMathLab* in 2006 when it was first implemented by the community college. During the years of 2006 and 2007 not all mathematics instructors were using *MyMathLab*. At the beginning of the 2008 school year, there was full implementation of *MyMathLab.* Developmental students earned a mean grade of a low B (4.0) during the 2008 school year. During this year, mathematics instructors were involved in several different professional developments provided by Pearson Education (developers of *MyMathLab*) on how to use and engage students in using their software. During the following school year 2009, the implementation of *MyMathLab* resulted in an increase of students' mean grades to a B (4.5). The following year Pearson Education provided professional development but not as comprehensively as the previous year. Thus, during the 2010 and 2011 school years students' grades began decreasing steadily to a mean grade of a low B (4.25, 4.1), respectively. During the 2012 school year, students earned a mean grade of a high C (3.85).

Students who utilize *MyMathLab* achieved greater success as determined by grade performance compared to students who did not use *MyMathLab*. The highest grade that students earned between the years 2001-2005 was a mean grade of a high C

(3.8), compared to the highest mean grade that students earned between the years 2008-2012, was a B (4.5) as displayed in Figure 6 by error bars.



Note. Years before using *MyMathLab*, 1.0 = 2001, 2.0 = 2002, 3.0 = 2003, 4.0 = 2004, 5.0 = 2005. Years using *MyMathLab*, 8.0 = 2008, 9.0 = 2009, 10.0 = 2010, 11.0 = 2011, 12.0 = 2012.

Figure 6. Math0376 grade distribution MyMathLab.

Question 1B the analysis included an examination of the success rate for students who enrolled in Math0376 using *MyMathLab* (2008-2012) as measured by pre and post *MyMathLab* tests. The standard deviation and variance are each based on all of the students' scores of *MyMathLab* pre-test. However, *MyMathLab* pre-test was not used for the study due to all students scoring a zero. Furthermore, the students' would be at zero when calculating the standard deviation and calculating the variance by squaring the standard deviation. Thus, there would be no standard deviation for the students' *MyMathLab* pre-test. As a result, multiple regression analysis was conducted to compare the results of Math0376 student's grades, number of semester's student enrolled, gender, and age on *MyMathLab* post-test scores. There was a statistically significant relationship between Math0376 students' grades, number of semester's student enrolled, gender, and age on *MyMathLab* post-test scores F(4, 95) =5.66 , p<.001 with an adjusted R^2 of .16 as displayed in Table 16.

Table 16
ANOVA Summary Math0376 with MyMathLab Post Scores

Source	*SS*	*df*	*MS*	*F*	*p*
Regression	109995.18	4	2748.80	5.66	<.001
Residual	46141.41	95	485.70		
Total	57136.60	99			

Pearson's correlation was computed to assess the correlation between Math0376 students' grades and *MyMathLab* post-test scores. There was a statistically significant correlation (n=100), albeit a weak correlation, between the two variables r = .223 and p = .013.

Question 2A and 2B Students' Performance before MyMathLab and with MyMathLab

The analysis of the data for question 2A and 2B included an examination of the comparison of the success rate for students who earned an A, B, or C in Math0375 and consequently enrolled in Math0376 before *MyMathLab* (2001-2005), as well as, those students who earned an A, B, or C in Math0375 and consequently enrolled in Math0376 with *MyMathLab* (2008-2012). Comparison of the mean of the grade distributions for Math0375 and Math0376 before *MyMathLab* and with *MyMathLab* will be discussed. Prior to the implementation of *MyMathLab*, Math0375 grades (M=3.67, SD=.73) and Math0376 grades (M=3.63, SD=.76) were similar. As a result of the implementation of *MyMathLab*, Math0375 mean grades increased from (M=3.67, SD=.73) to (M=3.76, SD=.80); while, Math0376 mean grades increased from (M=3.63, SD=.76) to (M=4.14, SD=.77). As shown, Math0375 increased .09 points whereas Math0376 increased .51 as displayed in Table 17.

Table 17
2001-2005 and 2008-2012 Math0375 and Math0376 Mean Grade Distribution

	Pre MyMathLab		*MyMathLab*	
	Math0375	Math0376	Math0375	Math0376
M	3.67	3.63	3.76	4.14
SD	.73	.76	.80	.77

Math0376 students before *MyMathLab* earned a mean grade of a C (3.63) in comparison to developmental students with *MyMathLab*, who earned a mean grade of a low B (4.14). As displayed by error bars in Figure 7, there was a statistically significant difference between academic performances in Math0376 most likely due to implementation of *MyMathLab*.

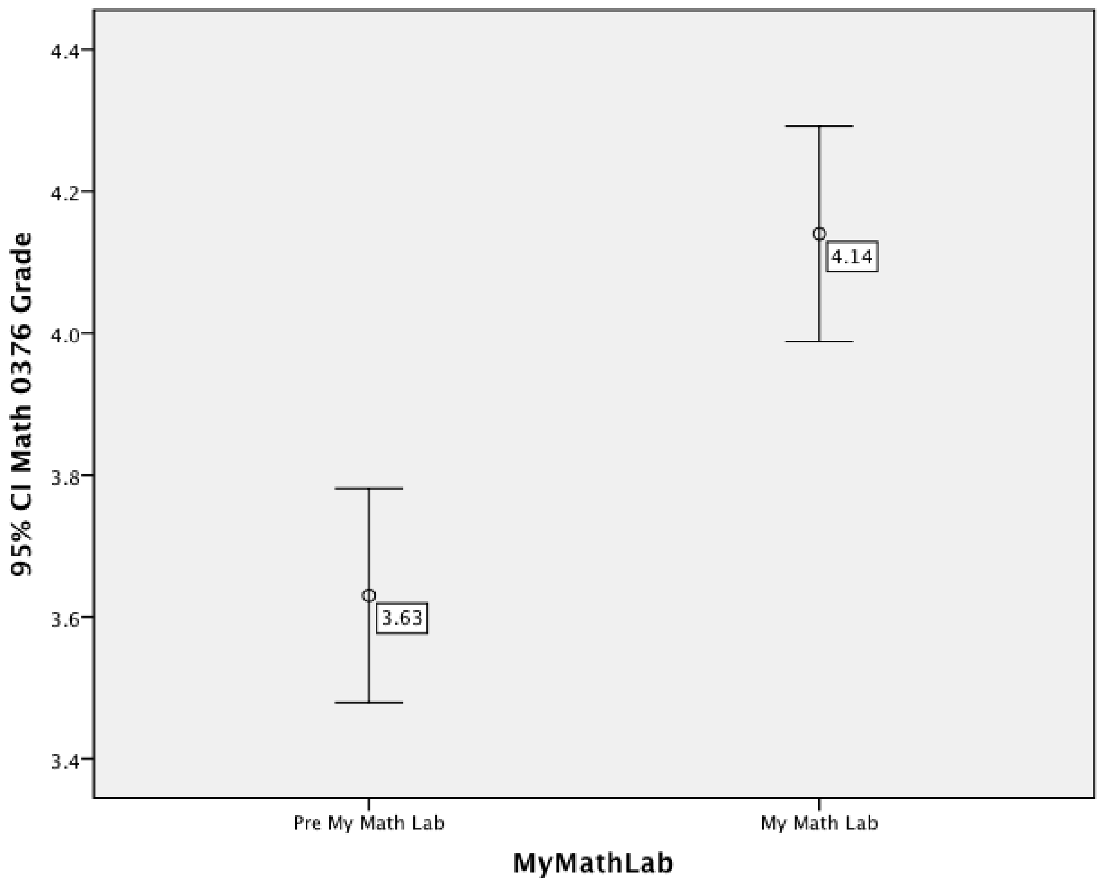


Figure 7. 2001-2005 and 2008-2012 Math0376 grade distribution MyMathLab.

Males enrolled in Math0376 before *MyMathLab* earned a mean grade of a C (3.64), while females earned a mean grade of a C (3.63). In comparison when using *MyMathLab,* males and females earned higher grades. The mean grade for males was a low B (4.02), while females had earned a mean grade of a low B (4.25).

For males, implementation of *MyMathLab* resulted in a higher mean score of 4.02 compared to 3.64 without using *MyMathLab*, however; 95% confidence interval overlapped indicating that there was not a statistically significant difference. For females on the other hand, with the implementation of *MyMathLab* resulted in a higher mean score of 4.25 compared to 3.63 without using *MyMathLab* seen by the non-overlap of the 95% confidence interval indicating that there was a statistically significant difference. Females resulted in a higher mean score of 4.25 whereas males scored 4.02. For females, the mean score was approximately .62 points higher whereas males was .38 points higher as shown in Figure 8.

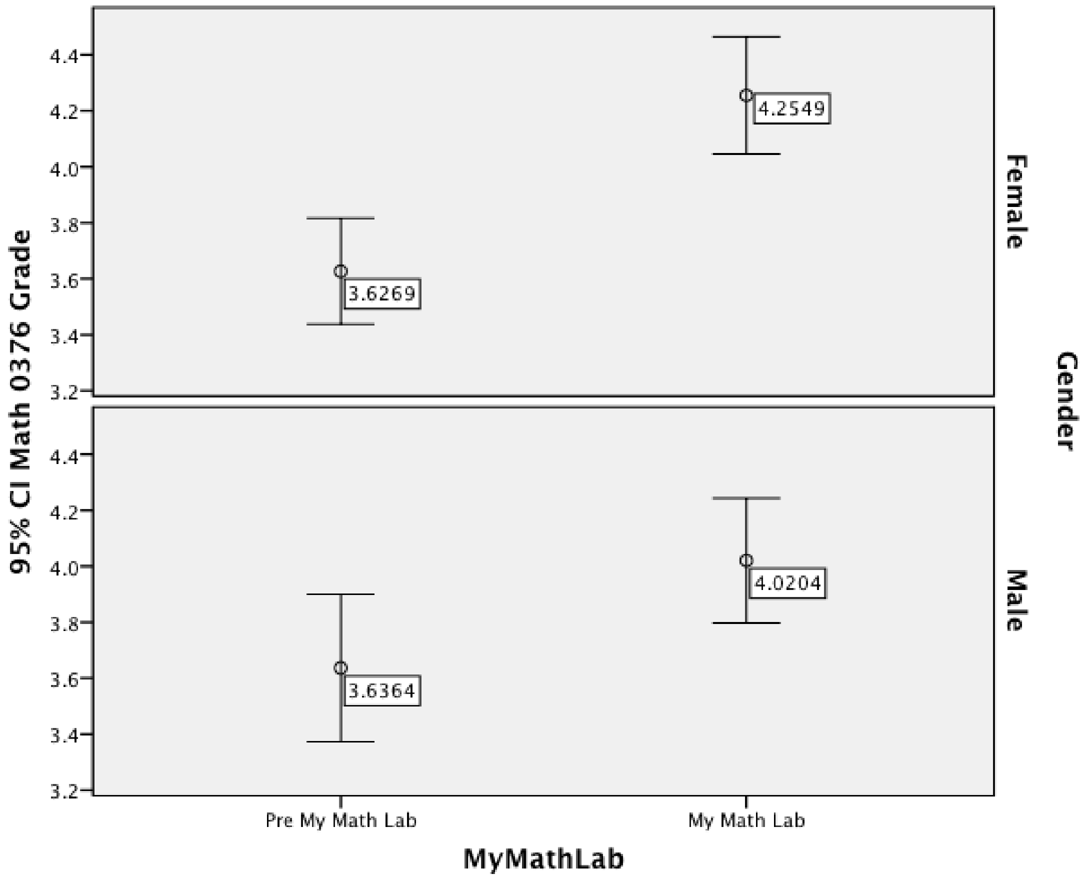


Figure 8. 2001-2005 and 2008-2012 Math0376 grade distribution by gender before MyMathLab.

For courses that did not use *MyMathLab*, a regression analysis was conducted to assess the relationship between student's grades in Math0375 on Math0376. There was a statistically significant relationship between Math0375 students' grades on Math0376 students' grades before using *MyMathLab* F(1, 98) = 5.68, p = .019 with an adjusted R^2 of .045 as displayed in Table 18.

Table 18
ANOVA Summary Math0376 before MyMathLab

Source	*SS*	*df*	*MS*	*F*	*p*
Regression	3.14	1	3.14	5.68	.019
Residual	54.17	98	.55		
Total	57.31	99			

For courses using *MyMathLab*, a regression analysis was conducted to assess the relationship between student's grades in Math0375 on Math0376. There was a statistically significant relationship between Math0375 students grades on Math0376 students grades when using *MyMathLab* F(1, 98) = 5.74, p = .019 with an R^2 of .046 as displayed in Table 19. Therefore, taken together, these results suggested that there is a statistically significant relationship between grades in Math0375 on Math0376 before and during the use of *MyMathLab*.

Table 19
ANOVA Summary Math0376 with MyMathLab

Source	*SS*	*df*	*MS*	*F*	*p*
Regression	3.21	1	3.21	5.74	.019
Residual	54.83	98	.56		
Total	58.04	99			

Question 3 Students' Performance in College Algebra before MyMathLab and with MyMathLab

The analysis of the data for question 3 included an examination of the success rate for students in Math1314 college algebra who exited the developmental education sequence either through *MyMathLab* enhanced course or a non-enhanced course.

Comparison of the mean grade distribution for Math0375, Math0376 and Math1314 before *MyMathLab* and with *MyMathLab* will be discussed. Prior to the implementation of *MyMathLab*, Math0376 mean grades were (*M*=3.63, *SD*=.76) and Math1314 mean grades were (*M*=2.08, *SD*=1.47). As a result of the implementation of *MyMathLab*, Math0376 mean grades increased from (*M*=3.63, *SD*=.76) to (*M*=4.14, *SD*=.77), while Math1314 mean grades increased from (*M*=2.08, *SD*=1.47) to (*M*=2.61, *SD*=1.62). As displayed in Table 20, Math0376 increased .51 points whereas Math1314 increased .53 points.

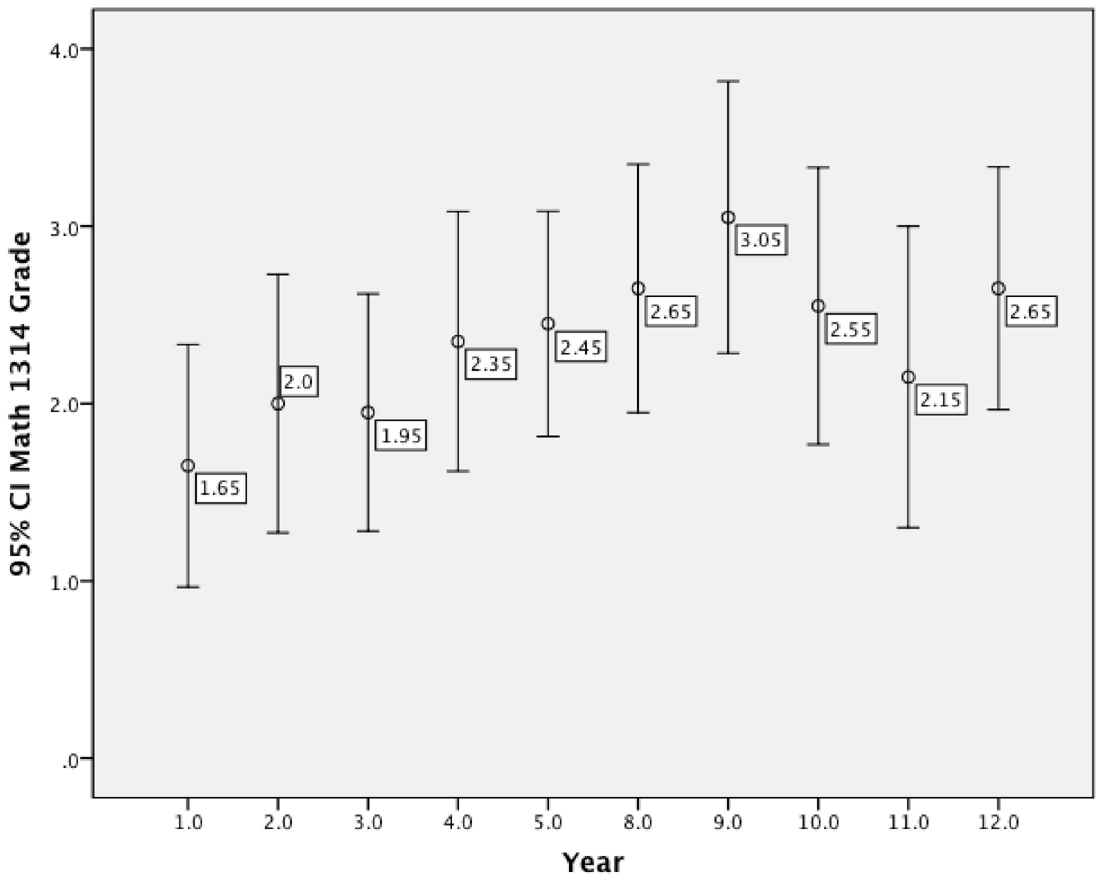
Table 20
2001-2005 and 2008-2012 Math0376 and Math1314 Mean Grade Distribution

	Pre MyMathLab		*MyMathLab*	
	Math0376	Math1314	Math0376	Math1314
M	3.63	2.08	4.14	2.61
SD	.76	1.47	.77	1.62

Developmental students were not using *MyMathLab* between the years 2001-2005. As displayed by error bars in Figure 8, students earned a mean grade of an F (1.65) in Math1314 during the year 2001. Then, the students' mean grades progressed to a low D (2.0) during the year of 2002 followed by a slight decline in 2003 where the mean grade was a high F (1.95). During the 2004 school year, students' mean grades improved to a low D (2.35). Beginning in 2005, students' mean grades had reached the highest level as compared to the previous years of 2001-2004. In this year, students earned a mean grade of a D (2.45).

Developmental students began using *MyMathLab* in 2006 when it was first implemented by the community college. During the years of 2006 and 2007 not all mathematics instructors were using *MyMathLab*. At the beginning of the 2008 school year, there was full implementation of *MyMathLab.* Developmental students earned a mean grade of D (2.65) during the 2008 school year. During this year, mathematics instructors were involved in several different professional developments provided by Pearson Education (developers of *MyMathLab*) on how to use and engage students using their software. During the following school year 2009, the implementation of *MyMathLab* resulted in an increase of students' mean grades to a low C (3.05). The following year Pearson Education provided professional development but not as comprehensively as the previous year. Thus, during the 2010 and 2011 school years students' mean grades began decreasing steadily on average to a low D (2.55, 2.15) respectively. During the 2012 school year, students earned a mean grade of a D (2.65).

Students who utilize *MyMathLab* achieved greater success as determined by grade performance compared to students who did not use *MyMathLab*. The highest mean grade that students earned between the years 2001-2005 was a D (2.45), compared to the highest mean grade that students earned between the years 2008-2012, a low C (3.05). As displayed in Figure 9, in the twelve year span and possibly because of *MyMathLab,* students' performance was able to increase by an entire letter grade.



Note. Years before using *MyMathLab*, 1.0 = 2001, 2.0 = 2002, 3.0 = 2003, 4.0 = 2004, 5.0 = 2005. Years when using *MyMathLab*, 8.0 = 2008, 9.0 = 2009, 10.0 = 2010, 11.0 = 2011, 12.0 = 2012.

Figure 9. Math1314 grade distribution before MyMathLab.

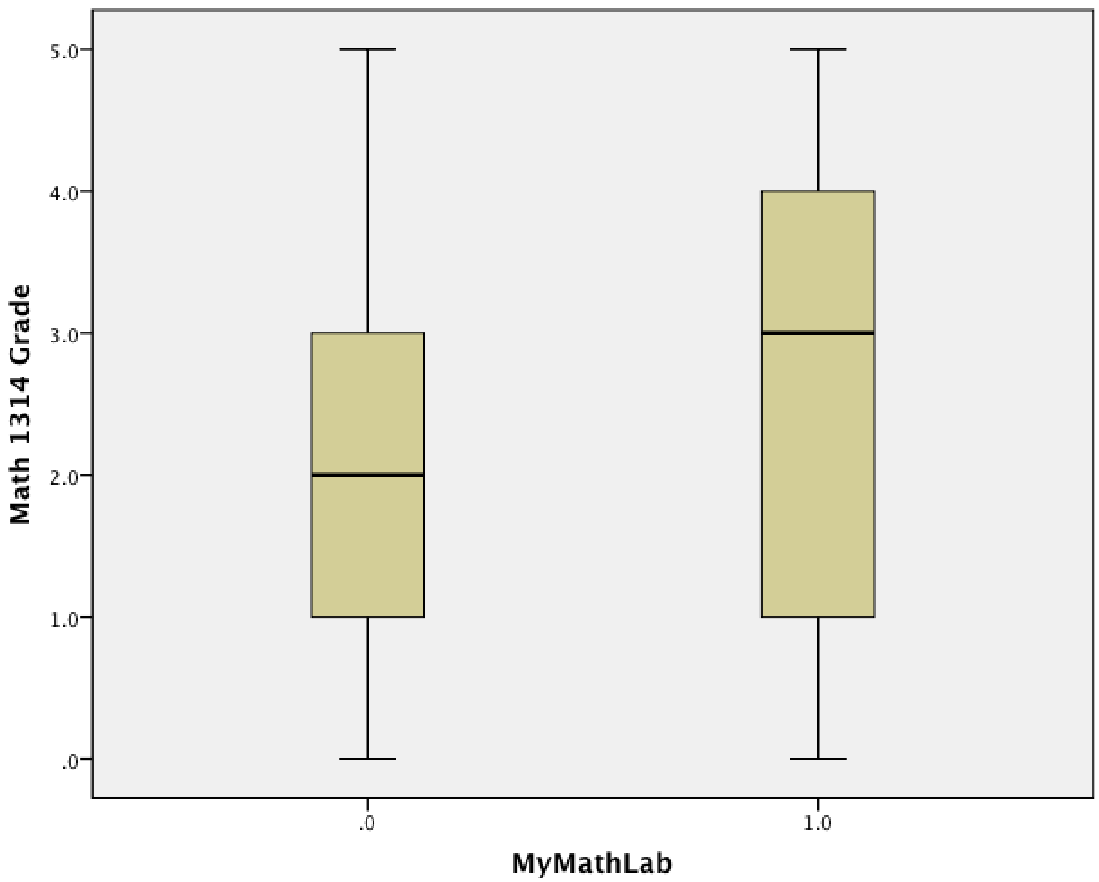
Individual student results are displayed by the back-to-back stem-leaf plot in Figure 10. Before using *MyMathLab*, 4 students earned an A, 17 earned a B, 20 earned a C, 18 earned a D, 24 earned an F, and 17 students withdrew from the course with a W. Students using *MyMathLab*, 11 students earned an A, 27 earned a B, 18 earned a C, 13 earned a D, 18 earned an F, and 13 students withdrew from the course with a W.

Pre MyMathLab	*Stem*	*MyMathLab*
00000000000000000	W	0000000000000
111111111111111111111111	F	111111111111111111
222222222222222222	D	2222222222222
33333333333333333333	C	333333333333333333
44444444444444444	B	444444444444444444444444444
5555	A	55555555555

Note: Letters are grades with W representing withdrawn from class before earning a grade.

Figure 10. 2001-2005 Math1314 grade distribution before MyMathLab *and* 2008-2012 Math1314 grade distribution with MyMathLab.

The box-plot indicates that the 50th quartile before using *MyMathLab* was a D (2.0). In comparison with using *MyMathLab*, the 50th quartile increased to a C (3.0). As shown, the 75th quartile increased from a C (3.0) to a B (4.0) and possibly because of *MyMathLab*, students' performance was able to increase by an entire letter grade as displayed in Figure 11.



Note. .0 = before using *MyMathLab* and 1.0 = with using *MyMathLab*

Figure 11. 2001-2005 and 2008-2012 Math1314 grade distribution before MyMathLab and using MyMathLab.

For courses that did not use *MyMathLab*, a regression analysis was conducted to assess the relationship between students' grades in Math0375 and Math0376 on Math1314. There was a statistically significant relationship between Math0375 and Math0376 students' grades on Math1314 students' grades before using *MyMathLab* F(2, 97) = 10.48, p<.001 with an adjusted R^2 =.161 as displayed in Table 21.

Table 21
ANOVA Summary Math1314 before MyMathLab

Source	*SS*	*df*	*MS*	*F*	*p*
Regression	38.27	2	19.13	10.48	<.001
Residual	177.10	97	1.83		
Total	215.36	99			

For courses using *MyMathLab*, a regression analysis was conducted to assess the relationship between students' grades in Math0375 and Math0376 on Math1314. There was a statistically significant relationship between Math0375 and Math0376 students' grades on Math1314 students' grades with using *MyMathLab* F(2, 97) = 5.15, p=.007 with an adjusted R^2 =.077 as displayed in Table 22.

Table 22
ANOVA Summary Math1314 with MyMathLab

Source	*SS*	*df*	*MS*	*F*	*p*
Regression	24.76	2	12.38	5.15	.007
Residual	233.03	97	2.4		
Total	257.79	99			

For courses that did not use *MyMathLab*, a Pearson's correlation was computed to assess the correlation between students' grades in Math0375 and Math1314. There was a statistically significant correlation (n=100) between the two variables r = .27 and p = .003. Also, a Pearson's correlation was computed to assess the correlation between students' grades in Math0376 and Math1314. There was a statistically significant correlation between the two variables r = .39, n = 100, p< .001.

For courses using *MyMathLab*, a Pearson's correlation was computed to assess the correlation between students' grades in Math0375 and Math1314. There was no significant correlation (n=100) between the two variables r = .15 and p = .065. Also, a Pearson's correlation was computed to assess the correlation between students' grades in Math0376 and Math1314. There was a statistically significant correlation (n=100) between the two variables r = .30 and p = .001.

Question 4 Impact of Instructor Characteristics Performance in Developmental and College Algebra Courses

Data from two surveys were analyzed to answer question 4 to examine the characteristics of community college mathematics instructors that may have contributed to student successes or failures in the developmental and college algebra classes. On the first survey *MTEBI*, differences between 18 instructors' responses to the survey were analyzed through the use of descriptive statistics examining the differences between instructors' responses on the two sub-constructs of *PTE* and *TOE*. The data were analyzed through the use of descriptive statistics to examine the mean scores for both personal teaching efficacy and teaching outcome expectancy.

On the *MTEBI* survey see Appendix A, 19 questions were grouped into a scale of three levels (high represents: 1 Strongly Agree and 2 Agree, medium represents: 3 Uncertain, and low represents: 4 Disagree and 5 Strongly Disagree) see Table 23. The mean for each instructor in the high group ranged from 1.22 to 2.33 (*M*=1.67, *SD*=.044), the mean for each instructor in the medium group ranged from 2.67 to 3.17 (*M*=2.85, *SD*=.27), and the mean for each instructor in the low group ranged from 3.56 to 4.78 (*M*=4.28, *SD*=.42). The mean for the high group consisted of questions: 2, 5, 9, 10, 11, 14, 15, and 18. The mean for the medium group consisted of questions: 4, 12, and 13. The mean for the low group consisted of questions: 1, 3, 6, 7, 8, 16, 17, and 19.

The mean for the high group represented mathematics instructors who possessed good pedagogical content knowledge and taught students using different types of strategies to engage the students. These instructors also possessed conceptual understanding of mathematic objectives being covered in the classroom and thus were able to explain concepts and procedural steps clearly to students. These instructors also answered questions that the student had and provided them with proper feedback. As a result, the instructors possessed the ability to teach effectively and possessed a positive effect on the students’ learning.

The mean for the medium group represented mathematics instructors who had also good pedagogical content knowledge and taught students using different types of strategies to engage the students. Also, these instructors were categorized as uncertain of their teaching approach to students' mathematic performance. These instructors were unsure if the students learned the mathematics content because of their teachings or if the students learned the content on their own. As a result, these instructors were uncertain of their teaching approach and the achievement of their students related to their pedagogical content knowledge.

The mean for the low group represented instructors who had poor pedagogical content knowledge and were unable to adequately engage and monitor students' performance in classrooms. These instructors were in effective in the classroom and did not have the necessary skills to teach the content. These instructors felt they couldn't provide proper feedback to students over the mathematics content that was covered. As a result, these instructors did not have the ability to teach effectively and had a negative effect on student learning.

On the MTEBI, the sub-construct of the PTE overall mean of the mathematic instructors ranged from 2.36 to 3.27 (M=2.83, SD=.24) see Table 23. PTE was measured by 12 questions: 2, 3, 5, 6, 8, 11, 14, 15, 16, 17, 18, and 19 see Appendix D. These mathematics instructors were uncertain if they were able to find different types of strategies to engage students in mathematics. They also were uncertain if they had conceptual understating of the objectives being covered in the classroom and taught mathematics concepts effectively. Also, these instructors were uncertain if they were able to answer questions from students and were uncertain if they were able provide them with proper feedback. As a result, these mathematics instructors were uncertain if they had the ability to teach effectively in the classroom.

On the *MTEBI*, the second sub-construct of the *TOE* overall mean of the mathematic instructors ranged from 1.86 to 3.86 (*M*=2.90, *SD*=.56) see Table 23. *TOE* was measured by 7 questions: 1, 4, 7, 9, 10, 12, and 13 see Appendix D. These mathematic instructors were uncertain on using different strategies to teach their students and uncertain if their students were able to understand and learn the mathematics content of the specific class they were teaching. These instructors were also uncertain if they effectively taught students to succeed and achieve in college. Also, they provided extra attention for students who needed this in order to succeed in the classroom. As a result, these mathematics instructors were uncertain if they had a positive effect on students learning.

Table 23

MTEBI Scale and Sub-Construct of Personal Teaching Efficacy and of Teaching Outcome Expectancy Scale

	SA					*A*			*U*			*D*					*SD*	
				High					*Medium*					*Low*				
1.2	1.22	1.22	1.56	1.67	2.00	2.11	2.33	2.67	2.72	3.17	3.56	3.78	4.22	4.33	4.44	4.50	4.67	4.78
Q2	Q18	Q15	Q11	Q5	Q14	Q9	Q10	Q4	Q13	Q12	Q1	Q7	Q19	Q8	Q6	Q16	Q17	Q3
				M=1.67 , SD=.04					M= 2.85, SD=0.27						M=4.28 , SD=0.42			

Note: 1=SA =Strongly Agree, 2=A =Agree, 3=U =Undecided, 4=D =Disagree, 5=SD =Strongly Disagree

On the second survey *IEP* consisting of 25 questions see Appendix B, a paired-samples *t*-test was conducted to compare the personal teaching efficacy in the means of the learner-centered approach and teacher-centered approach. There was a statistically significant difference in the means for the learner-centered approach (M=1.38, SD=.18) and teacher-centered approach (M=1.18, SD=.14), $t(17)=4.26$, p =.001, d=1.27, and r =.54. Thus, these results suggested that a teacher-centered approach had an effect on personal teaching efficacy.

Summary

In conclusion, parametric methods were useful in analyzing grade distributions for developmental courses, a college level course, and two surveys. The investigation consisted of: 1) Math0375, Math0376, and Math1314 (2001-2005) grade distribution, 2) Math0375, Math0376, and Math1314 (2008-2012) grade distribution, and 3) two surveys. This study provided insight into the process of using the web-based program *MyMathLab* in developmental courses. Chapter 5 provides insights found in the literature review as well as contributions of this study and possible future research needs based on the findings of this study.

5. SUMMARY AND CONCLUSIONS

Introduction

In this study, I explored research in developmental mathematics education. This research contained information regarding students' academic performance with the use of *MyMathLab* in developmental mathematic courses. Furthermore, the research also contained information regarding the quality of teacher effectiveness in the developmental education classroom.

Problem Statement

Developmental mathematics courses have the highest rates of failure; thus, students are not succeeding in the subject area of mathematics, which prevents them from achieving their educational goals (Bonham & Boylan, 2011). This dissertation mirrors findings from Belcheir (2002) who concluded that further research was still needed to be done in understanding how students can be successful in mathematics course requirements in college. Thus, (Ashby et al., 2011) future research is needed to further examine success rates of developmental mathematics students in online and blended learning environments.

This study focused on whether a web-based technology, *MyMathLab*, made a difference in developmental students' successes in both a developmental mathematics course and a subsequent College Algebra course. Additionally, for this study I examined whether the effect differed by instructors' characteristics contributing to successes or failures of students in developmental mathematic courses. This analysis explored data from each developmental student including grade distributions and *MyMathLab* pre-test and post-test for certain years. For the instructors, data were gathered from the two surveys. The grade distribution from 2001-2005 before using *MyMathLab* and the grade distributions from 2008-2012 using *MyMathLab* and the two surveys were analyzed using SPSS. A limitation of this study was my inability to obtain access to the data connecting instructors to their course grades.

Summary of Results

Analysis revealed that students' grade performance and students success rate in Math0375 and Math0376 courses was higher when using *MyMathLab* compared to students not using *MyMathLab*. The analysis also revealed that with the implementation of *MyMathLab*, both Math0375 and Math0376 students had higher mean grades (M=3.76, SD=.80) and (M=4.14, SD=.77) respectively. Furthermore, the analysis revealed that with the implementation of *MyMathLab*, both Math0376 and Math1314 students had higher mean grades (M=3.63, SD=.76) and (M=2.61, SD=1.62) respectively. Students' grade performance and students success rate in Math0376 and Math1314 courses was higher when using *MyMathLab* as compared to students not using *MyMathLab.* Thus, the analysis revealed that with the implementation of *MyMathLab* taken on average the typical student was able to increase their academic performance in Math0375, Math0376 and Math1314.

Analyses revealed that on the (*MTEBI)*, 19 questions were grouped into three levels (high, medium, and low). The overall mean of the mathematic instructors of the high group ranged from 1.22 to 2.33 (*M*=1.67, *SD*=.44). These instructors had the ability to teach effectively and had a positive effect on the students' learning. The overall mean of the mathematic instructors of the medium group ranged from 2.67 to 3.17 (*M*=2.85, *SD*=.27). These instructors were uncertain of having the ability to teach effectively and uncertain about their ability to have a positive effect on student learning. The overall mean of the mathematic instructors of the low group ranged from 3.56 to 4.78 (*M*=4.28, *SD*=.42). These instructors did not express the ability to teach effectively and did not express feeling they have a positive effect on the students' learning. On the *MTEBI*, the sub-construct of the *PTE* overall mean of the mathematic instructors ranged from 2.36 to 3.27 (*M*=2.83, *SD*=.24). This overall mean indicates that these mathematics instructors were uncertain if they had the ability to teach effectively. On the *MTEBI*, the second sub-construct of the *TOE* mean ranged from 1.86 to 3.86 (*M*=2.90, *SD*=.56). The overall mean indicates that these mathematics instructors were uncertain if they had a positive effect on students learning.

On the second survey (*IEP*) consisting of 25 questions, a paired-samples *t*-test was conducted to compare the personal teaching efficacy based on a learner-centered approach and a teacher-centered approach. There was a statistically significant difference between the mean personal teaching efficacy for the learner-centered and teacher-centered approach. The instructors' personal teaching efficacy was a more teacher-center approach rather than a learner-center approach.

Discussion of Results

Question 1A and 1B revealed that there was a higher success rate for students when using *MyMathLab* and students' grade performance was higher when using *MyMathLab* as compared to students not using *MyMathLab*. Also, the questions revealed that the highest mean grade that students earned between the years 2008-2012 which was a B (4.5) in 2009, compared to the highest mean grade that students earned between the years 2001-2005 was a high C (3.85). Students' grades kept increasing from the years 2001-2009. In 2009, Pearson Education provided professional development but not as comprehensively as the previous year. Grades started declining after 2009; possibly more professional developments should have been implemented to determine if students' grades increased or to take note if students' grades continued decreasing. Overall, there was still a higher success rate for students when using *MyMathLab* because the lowest grade that students earned between the years 2008-2012, was higher than the highest grade earned between the years 2001-2005. A Pearson's correlation was computed to assess the correlation between Math0376 students' grades and *MyMathLab* post-test scores. The posttest questions consisted of only 10 items. There was a statistically significant weak correlation using this posttest. This was more than likely due to the fact that the posttest score did not determine if the student was advancing to the next course. The final grade was the grade that indicated advancement of the student to the next course not the posttest score.

A notable interest of the results indicated that there was no statistically significant difference between males and females in terms of academic performance.

Male and female students had an average grade of a high C. Gender did not play a factor in grade performance. This supports the research that indicates males and females do not differ in terms of mathematical achievement when it comes to grade performance (Gliner, 1987; Hebree, 1990; Ma, 1999; Perez, 2012).

Question 2A and 2B revealed that there was a higher success rate for students when using *MyMathLab*, both Math0375 and Math0376 students' grade performance was higher as compared to students not using *MyMathLab*. Students' academic performance improved about half a letter grade with the use of *MyMathLab*. Previous researchers (Spradlin & Ackerman, 2010) analyzed the difference between the academic performances of students taking a developmental mathematics course using traditional instruction as compared to students in classrooms supplemented with computer-assisted instruction; therefore they pointed out that those students using technology are engaged in a new pedagogical strategy for receiving instruction and thus improving students' academic performance.

Prior to using *MyMathLab* both male and female students, on average, earned a grade of a high C in Math0376. In comparison when using *MyMathLab*, both males and females earned higher grades with both earning a grade of B. Results from these questions revealed higher grades for both genders when using *MyMathLab*. A notable interest of the results for males indicated that there was no statistically significant difference between not using *MyMathLab* and the implementation of *MyMathLab* in terms of academic performance. In contrast, of notable interest from the results was that for females there was a statistically significant difference between not using *MyMathLab* and the implementation of *MyMathLab* in terms of academic performance. Before using *MyMathLab*, male students had a mean grade of 3.63 and female students had a mean grade of 3.64. When using *MyMathLab*, male students had a mean grade of 4.02 and female students had a mean grade of 4.25. When using *MyMathLab*, both male and female students had an average grade of a B. Yet, even though both females and males students earned a grade of a B, females still earned .23 points higher than the males. These results supported research indicating females outperform males in grade performance when it comes to using technology for learning (Hwang et al., 2009; Jonier et al., 2011).

Question 3 revealed that there was a higher success rate for students when using *MyMathLab*, Math1314 students' grade performance was higher as compared to students not using *MyMathLab*. Also, the question revealed that the highest mean grade that students earned between the years 2008-2012 was a low C (3.05) in 2009, compared to the highest mean grade D (2.45) that students earned between the years 2001-2005. Students' grades kept increasing from the years 2001 to 2009. In 2009, Pearson Education provided professional development but not as comprehensively as in previous year. After 2009 students' grades started declining, this indicates that possibly more professional developments should have been provided after 2009 to determine if students' grades could have increased or to take note if students' grades continued decreasing. Overall, there was still a higher success rate for students when using *MyMathLab* because the lowest mean grade that students earned between the years 2008-2012, was higher than the highest mean grade earned between the years 2001-

2005. Furthermore, 24% of students on average were earning more F grades in Math 1314 before using *MyMathLab*, while 27% of students on average were earning more B grades when using *MyMathLab*. Fifty-six percent of the students on average were passing Math1314 with a C or better with the implementation of *MyMathLab*, compared to 41% of students without using *MyMathLab*. Eleven percent of the students on average were passing Math1314 with an A with the implementation of *MyMathLab*, compared to 4% of students without using *MyMathLab*. With the implementation of *MyMathLab*, there was a 15% overall increase in passing rate. As Epper and Baker (2009) suggested, programs using technological designs have been identified as effective strategies for student success. Taken on average the typical student was able to increase their academic performance in class by a full letter grade. Previous researchers (Gleason, 2012; Spradlin & Ackerman, 2010) found that applying a solid technology component involving online homework, quizzes, and tests could help improve the impact of student achievement thus improving students' academic performance.

Question 4 revealed that the mean of 1.67, for the high group, represented mathematics instructors had good pedagogical content knowledge and taught students using different types of strategies to engage their students. These instructors also had a conceptual understanding of the objectives being covered in the classroom and provided proper feedback to the students. The mean of 3.03, for the medium group, represented this group of mathematics instructors that also possessed good pedagogical content knowledge and taught students using a variety of strategies to engage their students. Also, these instructors were uncertain of their teaching styles and were not sure if the students were grasping the content on their own. The mean of 4.39, for the low group, represented instructors who had poor pedagogical content knowledge and were unable to adequately engage students' performance. These instructors did not have the necessary skills to teach the content and felt they couldn't provide proper feedback to their students over the mathematics objectives. These instructors had a negative effect on their students learning due to their ability to teach effectively in the classroom. Previous researchers (Mireles, Westbrook, Ward, Goodson, & Jung, 2013) found that, there are several different types of innovations for helping developmental students succeed in developmental mathematics programs such as a) corequisite models, b) accelerated learning techniques, and c) technology centered methods.

On the *MTEBI*, the overall mean of 2.83 for the sub-construct of the *PTE* represented mathematic instructors who were uncertain if they were able to find different types of strategies to engage students in mathematics. They also were uncertain if they were teaching mathematics concepts effectively and if they had conceptual understanding of the mathematics objectives. Also, these instructors were uncertain if they were able to answer questions from students while given them proper feedback. Thus, these mathematics instructors were uncertain if they had the ability to teach effectively.

On the *MTEBI*, the overall mean of 2.90 for the second sub-construct of the *TOE* represented mathematics instructors were uncertain on using different strategies to teach their students and uncertain if their students were able to understand and learn the mathematics content of the specific class they were teaching. These instructors also were uncertain if they effectively taught students to succeed in college and were uncertain if they had a positive effect on students learning. Previous researchers (Thompson, Greer, & Greer, 2004) found that students indicated that there were twelve common characteristics of highly qualified teachers. Students conceptualized these twelve characteristics as good teaching and necessary for them to be able to learn from these teachers and that teachers who possessed these traits increased students' achievement level in higher education and their students had a positive and successful school experience. Thus, how students learn in the classroom had an effect on the teacher to teach effectively in the classroom. Previous research (Smittle, 2003) found that applying six principles for effective teaching were the product of integrating findings from successful developmental education programs. These principles will help better prepare educators in their quest to assist students in meeting their goals in college. Previous researchers (Mireles, Westbrook, Ward, Goodson, & Jung, 2013) found that, there were several different types of innovations for helping developmental students succeed in developmental mathematics programs such as a) corequisite models, b) accelerated learning techniques, and c) technology centered methods.

Recommendations

Because of the literature of review, certain issues deserve recommendation for further research. First, research should be conducted to determine if students' mathematics performance will increase by comparing college level mathematic courses with the implementation of *MyMathLab* and without the implementation of *MyMathLab*.

This will help to determine if *MyMathLab* will increase mathematics performance in college level courses and determine if developmental students go beyond the first credit college level courses.

Secondly, research should be conducted to determine if supplemental instruction combined with using *MyMathLab* increases mathematics performance. If the colleges can implement supplemental instruction integrated with *MyMathLab*, then maybe educators can increase student success in mathematics college level courses.

Third research question

In conclusion based on this study, it is suggested that further research be conducted with the following items in mind to compare participants from the university as well as community colleges and participants from different developmental courses as well as college level courses.

REFERENCES

Aichele, D. B., Francisco, C., Utley, J., & Wescoatt, B. (2011). Computer-aided college *Educator, 2*(3), 12-19.

Aizenman, N. C. (2008, February 12). *U.S. Latinos population projected to soar.* Washingtonpost.com (p. A03). Retrieved from http://www.washingtonpost.com/wp-dyn/content/article/2008/02/11/AR2008021101294.html

Ashby, J., Sadera, W. A., & McNary, S. W. (2011). Comparing student success between developmental math courses offered online, blended, and face-to-face. *Journal of Interactive Online Learning, 10*(3), 128-140.

Attewell, P., Lavin, D., Domina, T., & Levey, T. (2006). New evidence on college remediation. *The Journal of Higher Education, 77*(5), 886-924.

Aycaster, P. W. (2001). Factors impacting success in community college development mathematics courses and subsequent courses. *Community College Journal of Research & Practice, 25*(6), 403-416.

Bahr, P. R. (2008). Does mathematics remediation work?: A comparative analysis of academic attainment among community college students. *Research in Higher Education, 49*(5), 420-450.

Bailey, T. (2009a). Challenge and opportunity: Rethinking the role and function of developmental education in community college. In A. C. Bueschel & A. Verezia (Eds.), *Policies and practices to improve student preparation and success* (New Directions for Community Colleges, No. 145, pp. 11-30). San Francisco, CA: Jossey-Bass. doi:10.1002/cc.352

Bailey, T. (2009b). Rethinking developmental education in community college. *Community College Center, 40,* 1-4.

Bailey, T., Jeong, D. W., & Woo Cho, S. (2010). Referral, enrollment, and completion in developmental education sequences in community college. *Economics of Education Review, (29)*2, 255-270.

Bates, A. B., Latham, N., & Kim, J. (2011). Linking preservice teachers' mathematics self-efficacy and mathematics teaching efficacy to their mathematical performance. *School Science and Mathematics, 111*(7), 325-333.

Baxter, J. L., & Smith, S. (1998). Subsequent-grades assessment of pedagogies in remedial mathematics. *PRIMUS, 8*(3), 276-288.

Belcheir, M. J. (2002). What predicts success in intermediate algebra? *Research Reports*. Retrieved from http://files.eric.ed.gov/fulltext/ED480929.pdf

Boggs, S., Shore, M., & Shore, J. (2004). Using e-learning platforms for mastery learning in developmental mathematics courses. *Mathematics and Computer Education, 38* (2), 213-220.

Boone, H. N., Gartin, S. A., Wright, C., Lawrence, L. D., & Odell, K. (2002). Adult education philosophies practiced by agricultural education teachers in Pennsylvania, Virginia, and West Virginia. *Journal of Agricultural Education, 43*(3), 37-48.

Bonham, B. S., & Boylan R. (2011). Developmental mathematics: Challenges, promising practices, and recent initiatives. *Journal of Developmental Education, 34*(3), 2-10.

Borman, D., & Sleigh, A. (2011). An evaluation of the use of interactive approaches and integrated on-line resources. *Teaching Mathematics and Its Applications, 30*(4), 166-177.

Boylan, H. R., & Bonham, B. S. (1998, March). *Improving developmental education: What we've learned from 30 years of research.* Paper presented at the National Association for Developmental Education Conference, Detroit, MI.

Boylan, H. R. (2002). *What works: Research-based best practices in developmental Education.* Boone, NC: Continuous Quality Improvement Network/National Center for Developmental Education.

Boylan, H. R., Sutton, E. M., & Anderson, J. A. (2003). Diversity as a resource in developmental education. *Journal of Developmental Education, 27*(1), 12-17.

Boylan, H. R. (2009). Targeted intervention for developmental education students (T.I.D.E.S.) *Journal of Developmental Education, 32*(3), 14-23.

Bremer, C. D., Center, B. A., Opsal, C. L., Medhanie, A., Jang, Y., & Geise, A. C. (2013). Outcome trajectories of developmental students in community colleges. *Community College Review, 41*(2), 154-175.

Brothen, T. (1998). Transforming instruction with technology for developmental students. *Journal of Developmental Education, 21*(3), 2-8.

Brothen, T., & Wambach, C. A., (2004). Refocusing developmental education. *Journal of Developmental Education, 28*(2), 16-33.

Burch, K. J., & Kuo, Y. (2010). Traditional vs. online homework in college algebra. *Mathematics and Computer Education, 44*(1), 53-63.

Buzzetto-More, N., & Ukoha, O. (2009). The efficacy of a web-based instruction and remediation program on student learning. *Issues in Informing Science and Information Technology, 6,* 285-298.

Can, B. T., Gunhan, B. C., & Erdal, S. O. (2012). Using mathematics in teaching science self-efficacy scale-UMSSS: A validity and reliability study. *Eurasia Journal of Mathematics, Science & Technology Education*, *8*(4), 269-281.

Conti, G. J. (2007). Identifying your educational philosophy: Development of the Philosophies Held by Instructors of Lifelong-learners (PHIL). *Journal of Adult Education, 34*(1), 19-35.

Comber, C., & Colley, A. (1997). The effects of age gender and computer experience upon computer attitudes. *Educational Research, 39*(2), 123-133.

Crisp, G., & Amaury, N. (2010). Hispanic student success: Factors influencing the persistence and transfer decisions of Latino community college students enrolled in developmental education. *Research in Higher Education, 51*(2), 175-194.

DePree, J. (1998). Small-group instruction: Impact on basic algebra students. *Journal of Developmental Education, 22*(1), 2-8.

Enochs, L. G., Smith, P. L., & Huinker, D. (2000). Establishing factorial validity of the mathematics teaching efficacy beliefs instrument. *School Science and Mathematics, 100*(4), 194-202.

Epper, R. M., & Baker, E. D. L. (2009). Technology solutions for developmental math: An overview of current and emerging practices. Funded by the William and Flora Hewlett Foundation and the Bill & Melinda Gates Foundation.

Fike, D. S., & Fike, R. (2012). The consequences of delayed enrollment in developmental mathematics. *Journal of Developmental Education*, *35(*3), 2-10.

Fowler, P. R., & Boylan, H. R. (2010). Increasing student success and retention: A multidimensional approach. *Journal of Developmental Education, 34*(2), 2-10.

Galbraith, M. W., & Jones, M. S. (2008). Experiential framework for teaching developmental mathematics. *Community College Enterprise, 14*(2), 23-36.

Gallard, A. J., Albritton, F., & Morgan, M. W. (2010). A comprehensive cost/benefit model: Developmental student success impact. *Journal of Developmental Education, 34*(1), 10-12.

Gleason, J. (2012). Using technology-assisted instruction and assessment to reduce the effect of class size on student outcomes in undergraduate mathematics courses. *College Teaching, 60*(3), 87-94.

Gliner, G.S. (1987). The relationship between mathematics anxiety and achievement variables. *School Science and Mathematics*, *87*(2), 81-87.

Hashemzadeh, N., & Wilson, L. (2007). Teaching with the lights out: What do we really know about the impact of technology intensive instruction? *College Student Journal, 41*(3), 601-612.

Hammerman, N., & Goldberg, R. (2003). Strategies for developmental mathematics at the college level. *Mathematics and Computer Education, 37*(1), 79-95

Hattie, J. (2003, October). *Teachers make a difference: What is the research evidence?* Paper presented at the meeting of the Australian Council for Educational Research annual conference, University of Auckland, NZ.

Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. *Journal for Research in Mathematics Education, 21*(1), 33-46.

Hoyt, J. E., & Sorensen, C. T. (2001). High school preparation, placement testing, and college remediation. *Journal of Developmental Education, 25*(2), 26-34.

Hwang, Y., Suk., Fisher, W., & Vrongistinos, K. (2009). Calibrating a measure of gender differences in motivation for learning technology. *Journal of Instructional Psychology, 36*(3), 259-272.

Illich, P. A., Hagan, C., & McCallister, L. (2004). Performance in college-level courses among students concurrently enrolled in remedial courses: Policy implications. *Community College Journal of Research and Practice, 28*(5), 435-453.

Jonier, R., Iacovides, J., Owen, M., Gavin, C., Clibbery, S., Darling, J., & Drew, B. (2011). Digital games, gender and learning in engineering: Do females benefit as much as males? *Journal of Science Educational Technology, 20*, 178-185.

Kahveci, M. (2010). Student’s perceptions to use technology for learning: Measurements integrity of the Modified Fennema-Sherman Attitudes Scales. *The Turkish Online Journal of Educational Technology, 9*(1), 185-201.

Keup, J. R. (1998). Using technology in remedial education. Retrieved from http://files.eric.ed.gov/fulltext/EJ816612.pdf

Kieftenbeld, V., Natesan, P., & Colleen, E. (2011). An item response theory analysis of the mathematics teaching efficacy beliefs instrument. *Journal of Psychoeducational Assessment, 29*(5), 443-454.

Kinney, P. D., & Robertson D. F. (2003). Technology makes possible new models for delivering developmental mathematics instruction. *Mathematics and Computer Education, 37*, 315-328.

Kirkup, G. (1995). Gender issues and learning technologies. *British Journal of Educational Technology, 26*(3), 218-219.

Kitchens, A. N., Barber, W. D., & Barber, D. B. (1991). Left brain/ right brain theory: Implications for developmental math instruction. *Review of Research in Developmental Education, 8*(3), 3-6.

Knowlton, D. S., & Simms, J. (2010). Computer-based instruction and generative strategies: Conceptual framework & illustrative example. *Computers in Human Behavior, 26*(2010), 996-1003.

Kogelman, S., & Warren, J. (1978). *Mind over math*. NY: The Dial Press.

Korkmaz, O. (2011). Study of the validity and reliability of a self-efficacy scale of teaching material utilization. *Educational Research and Reviews, 6*(15), 843-853.

Kozeracki, C. A., & Brooks, J. B. (2006). Emerging institutional support for developmental education. *New Directions for Community Colleges, 2006*(136), 63-73.

Kulik C. L., & Kulik, J. A. (1991). Effectiveness of computer-based instruction: An updated analysis. *Computers in Human Behavior. 7*, 75-94.

Lesik, S. A. (2007). Do developmental mathematics programs have a casual impact on student retention? An application of discrete-time survival and regression-discontinuity analysis. *Research in Higher Education, 48*(5), 583-608.

Li, N., & Kirkup, G. (2007). Gender and cultural differences in internet use: A study of China and the UK. *Computers & Education, 48*(2), 301.

Ma, X. (1999). A meta-analysis of the relationship between anxiety toward mathematics and achievement in mathematics. *Journal for Research in Mathematics Education, 30*(5), 520-540.

McCabe, R. H. (2003). *Yes we can! A community college guide for developing America's under-prepared.* Phoniex, AZ: League for Innovation in the Community College and American Association of Community Colleges.

Melguizo, T., Bos, J., & Prather, G. (2011). Is developmental education helping community college students persist? A critical review of the literature. *American Behavioral Scientists, 55*(173).

Mellow, G. O., Woolis, D. D., & Laurillard, D. (2011). In search of a new developmental-education pedagogy. *Change: The Magazine of Higher Learning, 45*(3), 50-59.

Merisotis, J. P., & Phipps, R. A. (2000). Remedial education in colleges and universities: What's really going on? *The Review of Higher Education, 24*(1), 67-85.

Minor, L. C., Onwuegbuzie, A. J., Witcher, A. E., & James T. L. (2002). Preservice teachers' educational beliefs and their perceptions of characteristics of effective teachers. *The Journal of Educational Research. 96*(2), 116-127.

Mireles, S. V., Offer, J., Ward, D. D., & Dochen, C. W. (2011). Incorporating study strategies in developmental mathematics and college algebra. *Journal of Developmental Education, 34* (3), 12-21.

Mireles, S. V., Westbrook, T., Ward, D. D., Goodson, J., & Jung, J. H. (2013). Implementing pre-homework in the developmental mathematics classroom. *Research & Teaching in Developmental Education, 29*(2), 5-11.

National Mathematics Advisory Panel. (2008). *Foundations for success: The final report of the National Mathematics Advisory Panel.* Washington, DC: U.S. Department of Education.

Nie, Y., Lau, S., & Liau, A. K. (2012). The teacher efficacy scale: A reliability and validity study. *The Asia-Pacific Education Researcher, 21*(2), 414-421.

Paravate, V., Anjaneyulu, K. S. R., & Rajan, P. (1998). Math magic: An adaptive remediation system for mathematics. *The Journal of Computers in Mathematics and Science Teaching, 17*, 265-284.

Payne, E., & Lyman, B. (1998). *Issues affecting the definition of developmental education.* Retrieved from www.umck.edu/cad/nade/index.htm

Pérez, A. I. (2012). Journal writing eases mathematics anxiety. *Academic Exchange Quarterly, 16*(1), 127.

Perin, D., & Charron, K. (2003). Trends in community college assessment and placement approaches: Implications for educational policy. *Informative Analyses*. (ERIC Document Reproduction Service No. ED478367).

Petta, T. D. (1998). Community on-line: New professional environments for higher education. *Directions for Teaching and Learning, (76)*2, 53-66.

Phelps, J. M., & Evans, R. (2006). Supplemental instruction in developmental mathematics. *The Community College Enterprise, 12*(1), 21-37.

Potocka, K. (2010). An entirely-online developmental mathematics course: Creation and outcomes. *PRIMUS, 20*(6), 498-516.

Rethlefsen, A. L., & Park, H. (2011). A mixed-method study: Assessing the BAR model's impact on preservice teachers' efficacy beliefs. *School Science and Mathematics, 111*(3), 102-117.

Rodgers, K., Posler, B., & Trible, L. (2011). A faster track: Decreasing the number of semesters students spend in developmental mathematics without lowering academic expectations. *PRIMUS, 21*(3), 252-262.

Roselle, A. (2008). Community college library practices in developmental education. *Journal of Developmental Education, 32*(2), 24- 32.

Rowe, K. R. (2003, October). *The importance of teacher quality as a key determinant of students' experiences and outcomes of schooling.* Background paper to keynote address presented at the ACER Research Conference 2003. Melbourne, Australia.

Saxon, D. P., & Boylan, H. R. (2001). The cost of remedial education in higher education. *Journal of Developmental Education, 25*(2), 2-9.

Schwartz, A. E. (2007). New standards for improving two-year mathematics instruction. *The Education Digest*, 39-42.

Sosa, T., & Gomez, K. (2012). Connecting teacher efficacy beliefs in promoting resilience to support of Latino students. *Urban Connection, 47*(5), 876-909.

Smittle, P. (2003). Principles for effective teaching in developmental education. *Journal of Developmental Education, 26*(3), 10-16.

Snyder, T. D., Tan, A. G., & Hoffman, C. M. (2006). *Digest of education statistics 2005 (NCES 2006-030). U.S. Department of Education, National Center for Education Statistics.* Washington, DC: U.S. Government Printing Office.

Spence, D. J. (2008). Traditional and online student reactions to the video tutor component of MyMathLab. *Proceedings of the 19th International Conference on Technology in Collegiate Mathematics,* 192-196.

Spradlin, K., & Ackerman, B. (2010). The effectiveness of computer-assisted instruction in developmental mathematics. *Journal of Developmental Education, 34*(2), 12-14.

Stigler, J. W., Givvin, K. B., & Thompson, B. J. (2010). What community colleges developmental mathematics students understand about mathematics. *MathAMATYC Educator, (1)*3.

Stronge, J. H., Ward, T. J., Tucker, P. D., & Hindman, J. L. (2007). What is the relationship between teacher quality and student achievement? Exploratory study. *Journal of Personnel Evaluation in Education*, *20*(3), 165-184.

Taylor, J. M. (2008). The effects of a computerized-algebra program on mathematics achievement of college and university freshman enrolled in a developmental mathematics course. *Journal of College Reading and Learning, (39)*1, 35-53.

Teranishi, R. T., Suarez-Orozco, C., & Suarez-Orozco, M. (2011). Immigrants in community colleges. *The Future of Children, 21*(1), 153-169.

Thompson, P. (2013). The digital natives as learners: Technology use patterns and approaches to learning. *Computers & Education, 65*, 12-33.

Thompson, S., Greer, J. G., & Greer, B. B. (2004). Highly qualified for successful teaching: Characteristics every teacher should possess. *Essays in Education, 10.*

Wadsworth, L. M., Husman, J., Duggan, M. A., & Pennington, M. N. (2007). Online mathematics achievement: Effects of learning strategies and self-efficacy. *Journal of Developmental Education, 30* (3), 6-14.

Walker, R. J. (2010). *12 characteristics of an effective teacher*. ERIC Digest. (ERIC Document Reproduction Service No. ED509938).

Ware, H., & Kitsantas, A. (2007). Teacher and collective efficacy beliefs as predictors of professional commitment. *Journal of Educational Research, 100*(5), 303-310.

Wayne, A. J., & Youngs, P. (2003). Teacher characteristics and student achievement gains: A review. *Review of Educational Research*, *73*(1), 89-122.

Weissman, J., Bulakowski, C., & Jumisko, M. K. (1997). Using research to evaluate developmental education programs and policies. *New Directions for Community Colleges, 100*, 73-80.

Wolfle, J. D. (2012). Success and persistence of developmental mathematics students based on age and ethnicity. *Community College Enterprise, 18*(2), 39-54.

Wong, A. (2013). Modularizing remedial mathematics. PRIMUS: Problems, *Resources & Issues in Mathematics Undergraduate Studies, 23*(3), 257-273.

Wright, S. (1998). The ill-prepared and the ill-informed. Story behind remediation feud in New York. *Black Issues in Higher Education, 15,* 12-15.

Wright, G. L., Wright, R. R., & Lamb, C. E. (2002). Developmental mathematics education and supplemental instruction: Pondering the potential. *Journal of Developmental Education, 26* (1), 30-35.

Xu, Y., Hartman, S., Uribe, G., & Mencke, R. (2001). The effects of peer tutoring of undergraduate students' final examination scores in mathematics. *Journal of College Reading and Learning, 32* (1), 22-31.

Zavarella, C. A., & Ignash, J. M. (2009). Instructional delivery in developmental mathematics: Impact on retention. *Journal of Developmental Education, 32*(3), 2-13.

APPENDIX A

Mathematics Teaching Efficacy Belief Instrument (MTEBI)

Please indicate the degree to which you agree or disagree with each statement below by bubbling in the appropriate letters on the SCANTRON provided.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
A	B	C	D	E

1. When a student does better than usual in mathematics, it is often because the teacher exerted a little extra effort.
2. I will continually find better ways to teach mathematics.
3. Even if I try very hard, I do not teach mathematics as well as I do most subjects.
4. When the mathematics grades of students improve, it is often due to their teacher having found a more effective teaching approach.
5. I know the steps necessary to teach mathematics concepts effectively.
6. I am not be very effective in monitoring mathematics activities.
7. If students are underachieving in mathematics, it is most likely due to ineffective mathematics teaching.
8. I generally teach mathematics ineffectively.
9. The inadequacy of a student’s mathematics background can be overcome by good teaching.
10. When a low-achieving students progresses in mathematics, it is usually due to extra attention given by the teacher.

11. I understand mathematics concepts well enough to be effective in teaching mathematics.
12. The teacher is generally responsible for the achievement of students in mathematics.
13. Students' achievement in mathematics is directly related to their teacher's effectiveness in mathematics teaching.
14. I find it difficult to use manipulatives to explain to students why mathematics works.
15. I am typically able to answer students' mathematics questions.
16. I wonder if I have the necessary skills to teach mathematics.
17. When a student has difficulty understanding a mathematics concept, I am usually at a loss as to how to help the student understand it better.
18. When teaching mathematics, I usually welcome student questions.
19. I do not know what to do to turn students on to mathematics.

APPENDIX B

Instructors' Educational Philosophies (IEP)

Directions: Please indicate agree or disagree with each statement below by bubbling in the appropriate letters on the SCANTRON sheet provided.

A= AGREE B= DISAGREE

1. In planning a mathematics lesson, I try to create a controlled environment that attracts and holds learners, moving them systematically towards the objective(s).
2. People learn best when they are free to explore, without the constraints of a "system."
3. In planning a mathematics lesson, I am most likely to assess learners' needs and develop valid learning activities based on those needs.
4. Decisions about what to include in a mathematics lesson should be made mostly by the learner in consultation with a facilitator.
5. Decisions about what to include in a mathematics lesson should be based on careful analysis by the teacher of the material to be covered and the concepts to be taught.
6. Good mathematics educators start planning instruction by asking learners to identify what they want to learn and how they want to learn it.
7. My primary role as a teacher of mathematics is to facilitate, but not to direct, learning activities.
8. Evaluation of mathematical learning outcomes is best accomplished when the learner encounters a problem, either in the learning setting or the real world, and successfully resolves it.

9. The learners' feelings during the mathematical learning process provide energy that can be focused on problems or questions.
10. As an adult educator, I am most successful in situations that are unstructured and flexible enough to follow learners' interest.
11. Good adult educators start planning instruction by considering the end behaviors they are looking for and the most efficient way of producing them in learners.
12. Decisions about what to include in a mathematics lesson should be based on careful analysis by the teacher of the material to be covered and the concepts to be taught.
13. Good adult educators start planning instruction by identifying problems that can be solved as a result of the instruction.
14. In planning a mathematics lesson, I try to create a clear outline of the content and the concepts to be taught.
15. Decisions about what to include in a mathematics lesson should be made mostly by the learner in consultation with a facilitator.
16. The learners' feelings during the learning process are used by the skillful adult educator to accomplish the learning objective(s).
17. In planning a mathematics lesson, I am most likely to identify, in conjunction with learners, significant social and political issues and plan learning around them.

18. In the end, if learners have not learned what was taught they do not recognize how learning mathematics will enable them to significantly influence society.
19. As a developmental mathematics educator, I am most successful in situations where the learners have some awareness of social and political issues and are willing to explore the impact of such issues on their daily lives.
20. My primary role as a teacher of adults is to increase learners' awareness of environmental and social issues and help them to have an impact on these situations.
21. The teaching methods I use emphasize practice and feedback to the learner.
22. Evaluation of learning outcomes should be built into the system, so that learners will continually receive feedback and can adjust their performance accordingly.
23. The learners' feelings during the learning process provide energy that can be focused on problems or questions.
24. Most of what people know they have gained through self-discovery rather than some "teaching" process.
25. In planning a mathematical lesson, I am most likely to clearly identify the results I want and construct a lesson that will almost run itself.

APPENDIX C

TEXAS A&M UNIVERSITY HUMAN SUBJECTS PROTECTION PROGRAM

Consent Form

Project Title: **Examining the Success of Students in Developmental Mathematics Courses in a Mostly Hispanic Border Town Community College**

You are invited to take part in a research study being conducted by Antonio G. Carranza III, a researcher from Texas A&M University. The information in this form is provided to help you decide whether or not to take part. If you decide to take part in the study, you will be asked to sign this consent form. If you decide you do not want to participate, there will be no penalty to you, and you will not lose any benefits you normally would have.

Why Is This Study Being Done?

The purpose of this study is to determine if using *CourseCompass* had an impact on student success in two developmental courses and an early algebra course.
.

Why Am I Being Asked To Be In This Study?

You are being asked to be in this study because you are presently or in the past have taught a developmental course at Laredo Community College.

How Many People Will Be Asked To Be In This Study?

Approximately 15 to 20 instructors will be invited to participate in this study locally.

What Are the Alternatives To Being In This Study?

No, the alternative to being in the study is not to participate.

What Will I Be Asked To Do In This Study?

You will be asked to complete two surveys about teaching developmental courses. Your participation in this study will last one day for 30 minutes.

Are There Any Risks To Me?

The things that you will be doing are no more than risks than you would come across in everyday life. Although the researchers have tried to avoid risks, you may feel that some questions/procedures that are asked of you will be stressful or upsetting. You do not have to answer anything you do not want to. Information about individuals and/or organizations that may be able to help you with these problems will be given to you.

Will There Be Any Costs To Me?
Aside from your time, there are no costs for taking part in the study.

Will I Be Paid To Be In This Study?
You will not be paid for being in this study

Will Information From This Study Be Kept Private?

The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely and only Antonio Carranza and his advisors at Texas A&M will have access to the records.
Information about you will be stored on my computer and the files are protected with a password. This consent form will be filed securely in an official area.

People who have access to your information include the Principal Investigator and research study personnel. Representatives of regulatory agencies such as the Office of Human Research Protections (OHRP) and entities such as the Texas A&M University Human Subjects Protection Program may access your records to make sure the study is being run correctly and that information is collected properly.

Information about you and related to this study will be kept confidential to the extent permitted or required by law.

Who may I Contact for More Information?
You may contact the Principal Investigator, Antonio Carranza to tell him about a concern or complaint about this research at **(956)235-2102 or acarranza@laredo.edu** .You may also contact the Protocol Director, Mary Margaret Capraro at 979-845-8384 or mmcapraro@tamu.edu.
For questions about your rights as a research participant; or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office at (979) 458-4067 or irb@tamu.edu.

What if I Change My Mind About Participating?
This research is voluntary and you have the choice whether or not to be in this research study. You may decide to not begin or to stop participating at any time. If you choose not to be in this study or stop being in the study, there will be no effect on your employment, evaluation, relationship with Laredo Community College or Texas A&M University. Any new information discovered about the research will be provided to you. This information could affect your willingness to continue your participation.

STATEMENT OF CONSENT

I agree to be in this study and know that I am not giving up any legal rights by signing this form. The procedures, risks, and benefits have been explained to me, and my questions have been answered. I know that new information about this research study will be provided to me as it becomes available and that the researcher will tell me if I must be removed from the study. I can ask more questions if I want. A copy of this entire consent form will be given to me.

______________________________ ______________________________________

Participant's Signature Date

________________________________ ______________________________________

Printed Name Date

INVESTIGATOR'S AFFIDAVIT:
Either I have or my agent has carefully explained to the participant the nature of the above project. I hereby certify that to the best of my knowledge the person who signed this consent form was informed of the nature, demands, benefits, and risks involved in his/her participation.

____

Signature of Presenter Date

____

Printed Name Date

APPENDIX D

Mathematics Teaching Efficacy Belief Instrument (MTEBI)

Please indicate the degree to which you agree or disagree with each statement below by bubbling in the appropriate letters on the SCANTRON provided.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
A	B	C	D	E

TOE 1. When a student does better than usual in mathematics, it is often because the teacher exerted a little extra effort.

PTE 2. I will continually find better ways to teach mathematics.

PTE 3. Even if I try very hard, I do not teach mathematics as well as I do most subjects.

TOE 4. When the mathematics grades of students improve, it is often due to their teacher having found a more effective teaching approach.

PTE 5. I know the steps necessary to teach mathematics concepts effectively.

PTE 6. I am not be very effective in monitoring mathematics activities.

TOE 7. If students are underachieving in mathematics, it is most likely due to ineffective mathematics teaching.

PTE 8. I generally teach mathematics ineffectively.

TOE 9. The inadequacy of a student's mathematics background can be overcome by good teaching.

TOE 10. When a low-achieving students progresses in mathematics, it is usually due to extra attention given by the teacher.

PTE 11. I understand mathematics concepts well enough to be effective in teaching mathematics.

TOE 12. The teacher is generally responsible for the achievement of students in mathematics.

TOE 13. Students' achievement in mathematics is directly related to their teacher's effectiveness in mathematics teaching.

PTE 14. I find it difficult to use manipulatives to explain to students why mathematics works.

PTE 15. I am typically able to answer students' mathematics questions.

PTE 16. I wonder if I have the necessary skills to teach mathematics.

PTE 17. When a student has difficulty understanding a mathematics concept, I am usually at a loss as to how to help the student understand it better.

PTE 18. When teaching mathematics, I usually welcome student questions.

PTE 19. I do not know what to do to turn students on to mathematics.